Estimating C-17 Aircrew Seasoning Given a Prediction of Flying Austerity

GRADUATE RESEARCH PAPER

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AFIT-ENS-GRP-14-J-13

DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AFIT-ENS-GRP-14-J-13

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Graduate Research Project

Presented to the Faculty

Department of Operational Sciences

Graduate School of Engineering and Management

Air Force Institute of Technology

Air University

Air Education and Training Command

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics

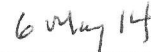Frank W. Rovello, MBA, BS

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June 2014

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Abstract

The purpose of this Graduate Research Project is to focus on estimating a minimum range in C-17 tails required to meet Air Mobility Command's (AMC) active duty aircrew seasoning requirements, given a prediction of future flying austerity.

The researcher employs a three phase case study. Phase one focuses on the historical analysis of asset allocation and the current process referred to as the Commander Air Force Forces Appropriation and Allocation Process (CAAP). Phase two begins the data analysis, focusing on sorties flown by active duty units from January to July 2013, which determines average training and mission sortie duration. Finally, phase three merges the results from phases one and two in order to estimate a minimum range in tails required to meet a targeted seasoning rate in hours per month for both basic and augmented crews.

The methodology employed concludes the CAAP is suited to monitor C-17 allocations to offload excess requirements in accordance with Department of Defense policy and prevent serious future readiness shortfalls given the unpredictable nature of the budget and reduced airlift demand in the event of future flying austerity.

Acknowledgements

I would like to take this opportunity to thank everyone involved in helping me with this Graduate Research Project. First and foremost, I thank my family. Without their patience and love, this would not have been possible. Thank you for understanding the sacrifices involved with this undertaking and not questioning the many hours of research and data analysis required to complete this endeavor.

Next, to my sponsors Colonel Steven Stater and Colonel William D. Hall who provided the background information, data, and support, your help and guidance has been much appreciated. I would also like to thank Mr. Adam Nyenhuis, Mr. Dave Young, Mr. Harold Rice, and Mr. John Golden. Thank you for your direction, wisdom, and insightfulness on this study. Your coordination and help was of great value, and I hope that I have delivered a product that will be of use for AMC well into the future.

Finally, I would like to thank my advisor Colonel Doral E. Sandlin who had the patience to endure my countless and nagging inquiries for feedback and guidance throughout this year-long research project. May God Bless you all in your continued service to our country, and may God Bless our Country.

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I. Introduction

General Issue

In September of 2013, during an interview with *Air Force Times*, Air Mobility Command's Commander, General Paul Selva candidly discussed the long-term impacts of the sequester, future budget cuts, and the effect of slowing airlift demand on a phrase that has largely been forgotten over the last decade—"aircrew seasoning" (Schogol, 2013, p. 1). Over the last 10 years, airlift has been in high demand and provided Air Mobility Command (AMC) the ability to secure valuable seasoning, development, and aging hours for C-17 pilots while simultaneously meeting our nations call to arms. As our nation withdraws from Afghanistan and returns to a peacetime readiness posture, AMC is concerned that a large reduction in airlift demand will make it difficult to season their rated force.

Background and Motivation

In the coming years, as operational flying requirements slow down and the United States completes its withdrawal from Afghanistan, AMC is forecasting a reduction in mission requests for C-17 airlift support. For the first time in a decade, AMC may transition from an excessive flying operations tempo to an austere operational tempo. Although reducing ops-tempo will allow our aircrews time to reconstitute at home, it will also reduce the range of opportunities to develop, upgrade, and season C-17 pilots, presenting AMC with a serious future readiness problem.

During the past decade the high demand for operational missions enabled aircrews to secure valuable seasoning hours in excess of the minimums and complete training requirements, while cargo users reimbursed Air Mobility Command from the Transportation Working Capital Fund (TWCF). A slowing operations tempo will force Air Mobility Command to allocate a larger portion of C-17 aircrew seasoning out of its Operational and Mission (O&M) budget. This will result in AMC flying C-17 missions for seasoning rather than operational requirements. Furthermore, with a slowing airlift demand, flying seasoning missions with less than maximum cargo loads is inefficient and cost prohibitive. Given the current fiscal crisis these types of inefficiencies must be minimized. Additionally, with less flying opportunities available to secure valuable flying hours and seasoning, squadrons will in-turn begin adding more pilots to individual training sorties, thereby reducing the quality of training per pilot. In the end, Air Mobility Command must be pro-active with future planning in an effort to become more efficient with training and seasoning opportunities without risking force readiness.

C-17 force readiness is critical to meeting United States National Security Strategy goals. The United States National Security Strategy requires that Air Mobility Command supply a seasoned C-17 crew force capable of "supporting a full spectrum of operations, from disaster relief and humanitarian missions to low intensity conflict and general war" (NSS, 2013, pp. 11-12). This is an immense challenge with the current fiscal constraints and competing Department of Defense priorities. Future fiscal challenges and slowing airlift demand will force AMC into flying austerity, where the minimal number of resources will be sourced to meet C-17 readiness requirements.

Problem Statement & Research Questions

As previously mentioned, the inability to season and upgrade aircrews is a serious

future readiness problem, given the unpredictable nature of the budget and slowing airlift

demand. This graduate research project will attempt to provide potential options to

combat future seasoning and readiness problems facing Air Force senior leaders and the

Mobility Air Force's crews. Specifically this paper will develop a methodology that

enables Air Mobility Command to estimate a range in minimum number of C-17 tails

required to meet aircrew seasoning requirements given a prediction of future flying

austerity.

The researcher will investigate and attempt to answer the key questions

concerning C-17 active duty aircrew seasoning.

1. What process does Air Mobility Command utilize to apportion and allocate active duty C-17 missions at the Combatant Commander, Major Command, and Unit level?
2. What is the active duty C-17 pilot aircrew seasoning/aging requirement and how is it calculated?
3. Given a ratio of inexperienced pilots to experienced pilots, what is the resulting number of inexperienced pilots per unit, based on Primary Mission Aircraft Inventory (PMAI), crew ratios (CR)?
4. Historically, what is the average training and mission sortie duration by active duty unit?
5. Given the results from questions 3 and 4; what range of tails can be suggested to the AMC/CC in order to meet the targeted seasoning hours for basic and augmented crews?
6. Given a prediction of flying austerity will require AMC to fund 100% of seasoning from the O&M budget; how many additional tails per year will AMC have to allocate?

In theory, the end result of this analysis will provide the AMC/CC with options

for future allocations and attempt to establish a minimum range in C-17 tails to meet

aircrew seasoning requirements in the event budget cuts or future flying austerity becomes reality.

Methodology

This research will take a case study approach, focusing on deductive logic and quantitative analysis in estimating the minimum range in number of C-17 tails tasked to meet aircrew seasoning requirements. The researcher will employ a qualitative case study and data analysis over three phases; phase one is the historical analysis of the current process in utilization, referred to as the Commander Air Force Forces (COMAFFOR) Appropriation and Allocation Process or CAAP for short.

Phase 2 is the quantitative analysis which will focus on the sorties flown by active duty units from January 2013 to July 2013. In phase 2, this research will focus on researching the current seasoning hour requirement and then use that information to determine the average training and mission sortie duration by unit. Phase 3 will use the analysis from phases 1 and 2 to provide an estimate of the minimum range in number of C-17 tails required to meet the targeted seasoning hours for both basic and augmented crews.

Assumptions & Limitations

Several assumptions were made in order to constrain the scope of the research project. The first assumption is that there will be a dramatic reduction in flying hours forcing AMC into a flying austerity environment where resources are constrained due to fiscal challenges and slowing Combatant Commander's demand for airlift. Thereby, reducing the current over seasoning of C-17 pilots Air Mobility Command has enjoyed

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over the past decade. Secondly, the COMAFFOR Apportionment and Allocation process is a relatively new and continually evolving mechanism. Therefore, the researcher will base his discussion and analysis off the signed concept of operations dated 2 July 2012.

This research assumes C-17 data provided by AMC/A1, AMC/A9, 618 AOC/XOND, and individual unit's contains data entry errors. However, human data entry error is deemed negligible to the overall analysis. Furthermore, the research assumes the AMC/A3T aging/seasoning rate per month is correct and will remain constant, as future fiscal challenges will not increase or reduce the current calculated rate. This project will not explore or enter into the debate about flying currency versus proficiency based on the AMC/A3T seasoning projection.

An assumption is made that Air Mobility Command will man units at 100% pilot manning based on fiscal year 2013 force structure and crew ratios. Additionally, the research assumes the AMC/A3T inexperienced to experienced pilot ratio per unit will remain within established balancing limits. The research assumes during flying austerity that an individual unit's tails will fly no more than one sortie per day, and that sortie will be flown at the average training (O&M fund) or average mission sortie (TWCF) duration determined via the analysis. This assumption was made based on historical averages that future local training missions will be flown to maximize training and seasoning while minimizing the use of constrained resources. Furthermore, the enroute mobility support locations, air refueling tracks, and assault zones utilized for currency training and seasoning will remain in place for years to come. Thus the average sortie durations will remain the same for future missions executing similar mission profiles. An assumption is made that active duty units co-located on the same station do not mix and match crews on

O&M or TWCF missions. Additionally, units will schedule one inexperienced first pilot per tail when basic crew compliment is evaluated and no more than two inexperienced pilots per tail when augmented crew compliments are evaluated.

In order for a C-17 pilot to be eligible for upgrade to aircraft commander a pilot must accrue 1000 total hours, and for this analysis it's assumed all inexperienced pilots joining a C-17 active duty unit will graduate UPT with 200 hours. Additionally, inexperienced pilots will accrue an additional 200 seasoning hours in the C-17 simulator in the 2 to 3 years prior to aircraft commander upgrade.   Moreover, unit commanders and operations officers will effectively monitor flying hours to ensure inexperienced pilots also receive enough hours of primary time before becoming experienced pilots, and ensure scheduling to upgrade pilots within a reasonable timeframe.

In regards to scope, the research will limit the analysis to Air Mobility Command's active duty C-17 pilot force, excluding C-17 Air Force Reserve and Air National Guard requirements.   Experienced pilots who are attached to units for flying duties are considered outside the scope of this study and are not captured in the analysis as the research focuses on only a unit's core pilots requiring seasoning. Next, the timeframe for the sample analysis will be bound from January to July 2013 and the research assumes an average of 30 days per month during January through June 2013 timeframe. Major shifts in operations that create significant increases or decreases to average sortie duration or future contingency operations and wars will affect potential analysis on this topic. Finally, the research will not discuss operational risk management or discuss risks or benefits of flying all missions with augmented or basic crews.

Implications

The goal of this study is to estimate the minimum range of C-17 tails tasked by AMC on daily basis in either basic or augmented crew compliments that will meet the established seasoning requirements. This research is not intended to compare, contrast, or debate the validity of the C-17 aircrew seasoning requirements or flying hour program. Rather, it provides Air Force Senior leaders with information and options in creating a common operating picture in developing a balanced allocation between seasoning and cost. Currently AMC employs no such tool or process to do this. Inherently, a future tool will meet both C-17 aircrew seasoning requirements and combatant commander requirements while providing the COMAFFOR with options for tasking tails with basic and/or augmented crew compliments.

The research project potentially enables Air Mobility Command to execute the aircrew seasoning program in a more effective manner by tasking and flying the minimum number of tails assuming future requirements dry up. Therefore, this is an opportunity to secure substantial fuel savings as the United States spends approximately $8 billion a year in aviation fuel with mobility forces consuming 50% of the fuel used on an annual basis (Maybury, 2012, p. 7). Thus, fuel savings and efficiency becomes an indirect effect, if the minimum range is executed accordingly.

The research is noteworthy, as the first attempt to correlate C-17 tail execution against a calculated seasoning rate. In essence, the research attempts to provide AMC with a process to monitor airlift allocation while simultaneously meeting training and seasoning objectives. Most importantly, this research offers Air Force leaders a potential tool to mitigate the adverse effects of future budget restrictions. Finally, the research lays

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initial ground work on how AMC can incorporate this methodology and apply it to other

weapon systems across the enterprise in order to meet aircrew seasoning requirements

while simultaneously avoiding readiness shortfalls in a peacetime posture.

II. Literature Review

"Those who don't know History are destined to repeat it"

- George Santayana

If flying austerity becomes reality, the future demand for air mobility may drop significantly in the years to come. Therefore, Air Mobility Command's driving requirement to fly sorties will not be to deliver vital cargo, passengers, or fuel but to ensure future readiness of the mobility air force through aircrew seasoning. By the end of the literature review, the reader will understand flying austerity, C-17 aircrew seasoning, the historical significance of aircrew seasoning, the AMC Flying hour program, the COMAFFOR Appropriation and Allocation Process (CAAP), and reasoning behind why flying hours are minimized to meet training and seasoning requirements.

Defining Aircrew Seasoning and Flying Austerity

To fully understand this complex situation a uniform definition of aircrew seasoning and flying austerity must be agreed on for context. Defining aircrew seasoning is a difficult task, but generally it's building the next generation of expertise to achieve a required balance of experience among skill-sets within a particular community (Schogol, 2013). The seasoning requirement is normally expressed as a targeted rate in hours per month. Moreover, seasoning is normally required up and until a point that a pilot has secured enough total flying time to be considered experienced or seasoned regardless of qualification. For the purposes of this research, a C-17 pilot is considered inexperienced until such a point that he or she has accrued enough hours to be considered for upgrade to aircraft commander. Additionally, Merriam-Webster's dictionary defines austerity as "a situation in which there is a lack of money or resources and they are rationed to the point

and utilized only on things that are necessary" (Merriam-Webster, 2013). Therefore, one can conclude flying austerity is reached when AMC is generating and flying the minimum number of assets in reaching a targeted aircrew seasoning rate as a means to achieve a goal.

The governing regulation prescribing policy and guidance for upgrading USAF C-17 crew members in meeting objectives is Air Force Instruction (AFI) 11-2C-17 Volume 1 (V1) dated 1 June 2012. The overall objective of the aircrew training and upgrade program is to develop and maintain a high state of readiness for the immediate and effective employment in exercises, peacekeeping operations, contingencies and war in any environment (AMC/A3TA, 2012). Paramount in meeting this objective and ensuring effective employment is the fact that C-17 pilots must master core competencies through continuous monthly training and seasoning. Over time, aviation communities build experience or seasoned crew members through a certified and structured upgrade process, usually based on a minimum number of hours to upgrade.

Historically, young and inexperienced pilots require a longer timeframe and a higher number of hours to upgrade. Mainly because a lack of prior flying experience and knowledge doesn't give them the vast knowledge set to tap into (Endsley & Robertson, 2000). Inexperienced pilots are generally recent graduates of USAF's Undergraduate Pilot Training (UPT) program and enter the C-17 First Pilot Initial Qualification (FPIQ) program at Altus Air Force Base, Oklahoma with approximately 250 to 260 hours of flying experience (SUPT, 2012).

Most graduates of the FPIQ program accrue an additional 20 hours of actual flying in the C-17, giving them 280 total hours upon graduation. This is depicted as the

green dots on the lower left side of Figure 1. Additionally, Figure 1 shows us the target

aging rate or seasoning requirement at 25 hours per month and the timeline on the bottom

gives us an idea of the length of time required to secure seasoning hours within the

Mobility Pilot Development (MPD) program--24 to 36 months. Figure 1 below indicates

most pilots attain the sufficient experiencing hours (800 hours) to change from

inexperienced to experienced pilots and begin the upgrade process. It is important to note

the Figure 1 only accounts for primary aircraft time and does not account for

approximately 200 hours accrued in the C-17 simulator during the FPIQ program and

quarterly phase simulators prior to aircraft commander upgrade (Vara, 2013).   However,

even though a pilot may have the hours and experience to justify upgrade it's not the only

factor, as commander endorsement is the final authority.
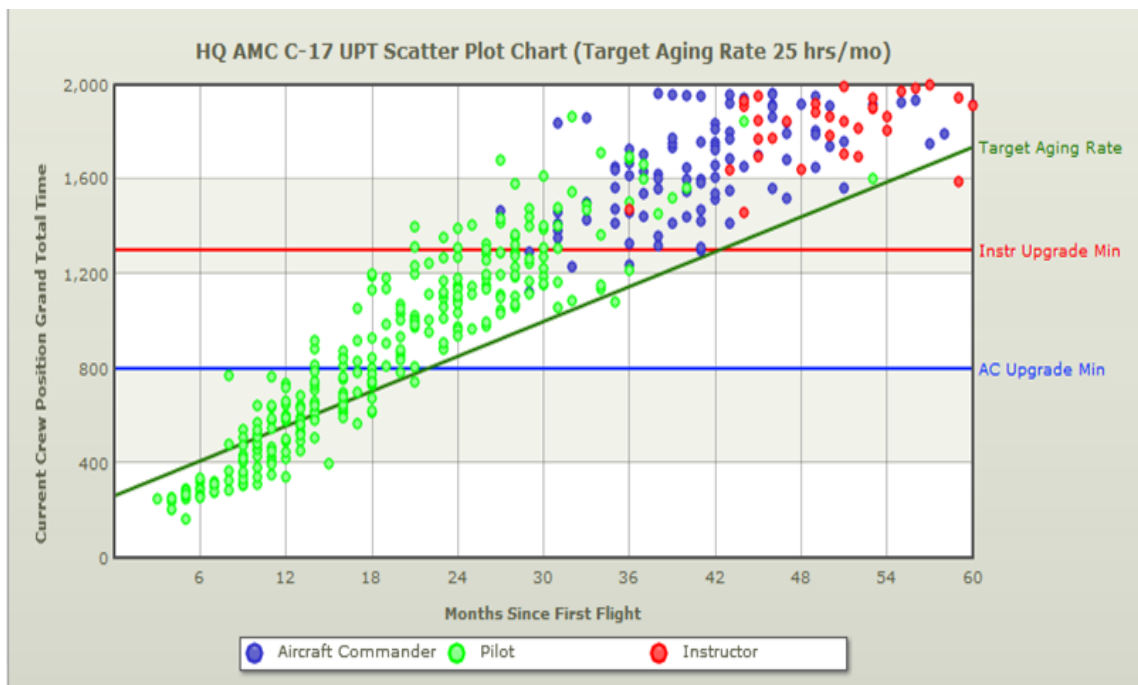
Figure 1: AAMS Scatter plot November 2013 (AMC/A3T, 2013)

In AFI-2C-17 V1, chapter five identifies the general prerequisites and training requirements necessary to upgrade and build experiencing into the community through the mobility development program. However, to be considered for upgrade within the MPD program, first pilots must log 1000 total flying hours of which 400 must be primary aircraft hours (AMC/A3TA, 2012). In regards to primary aircraft time, first pilots can only attain these hours when they are sitting at the controls. However all pilots on board may log other time when not at the controls, credited as additional seasoning hours towards the total hour requirement (USAF, 2010). Total flying hours represent all the flying time logged aboard a fixed-wing aircraft as a military pilot, including UPT, student, and other time. Simulator time is also creditable in meeting the total flying hour requirement. However, other time and C-17 simulator time is not creditable towards Primary Aircraft Assigned (PAA) time (AMC/A3TA, 2012).

In the end, the success of the MPD program depends on a seasoning additive, where inexperienced first pilots are mentored and provided with development opportunities. The unit's primary mentors in the seasoning process are the unit's more experienced aircraft commanders, instructor, and evaluator pilots who provide the recommendations to Operation's Officer and Commanders on the individual's capabilities and readiness for upgrade.

Seasoning's Historical Significance

An uncertain future flying environment is problematic and potentially more challenging then the last 10 years, especially given the DoD's current and long term fiscal challenges. In some ways, the flying environment for 2014 and beyond may

resemble the late 1990's flying environment. In the second half the 1990's the United States Air Force began to report a decline in the readiness levels of its combat support forces.

Why? A combination of complex, slowing airlift operations and political fiscal constraints reduced flying hours allocated to the force (Thaler & Dahlman, 2002). The Air Force struggled to meet aircrew seasoning requirements in the late 1990s, and there was not an established accounting method to match assets flown (i.e. tails) to a seasoning requirement. Rather, the Air Force utilized a programmed flying hour budget that often was never fully allocated and funded. This is because it was a programming tool and not based on assets actually flown and billed (Thaler & Dahlman, 2002).   Looking at 2014 and beyond, the same set of disturbing conditions appears to be re-surfacing in a more troublesome way. Much like the late 1990's, future readiness problems are coupled with fiscal constraints and overseas contingencies operations are concluding, as wartime polices are being rescinded.

In *Assessing Unit Readiness,* David Thaler and Carl Dahlman (2002) argue the ideal intensity during peacetime operations avoids excessive stress to personnel and aircraft without compromising experience gained from flying for aircrew seasoning. There is not necessarily an ideal point but potentially a range in managing operations. Furthermore, Research And Development (RAND) Corporation's Project Air Force has historically concluded AMC's units are organized, trained, and equipped to simultaneously satisfy two objectives: meet peacetime demand and maintain wartime readiness (Chow, 2003). Peacetime demand is vague and uncertain because it can fluctuate greatly and unexpectedly from humanitarian relief to rapid support to small

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scale contingencies. During the late 1990s, fiscal constraints, force reductions, and small scale contingencies defined the peacetime battle rhythm.

In the late 1990s, the Air Force went through some dramatic force and flying hour reductions. On the personnel side, Air Force Active Duty military personnel declined by 40 percent in comparison to the 1980s (Chow, 2003). Fiscal constraints hammered the flying hour program. This became evident during fiscal year (FY) 2000, where the average seasoning hours per C-17 co-pilot dropped to 27.8 hours per month, well below the required 35 seasoning hours per month required as depicted in Table 1 (Chow, 2003, p. 24). This lack of aircrew seasoning was not restricted to just one airframe but prevalent across the entire AMC force. This problem will appear again, unless the Air Force recognizes and implements a corrective action that matches assets flown (i.e. tails) to an established seasoning requirement. As the DoD transitions to a peacetime posture the same ingredients of the late 1990s are appearing again as the Air Force plans a reduction in size by 25,000 airmen and 550 aircraft over the next 5 years (Fanning, 2013).

Table 1: Target Monthly Seasoning Hours (Chow, 2003)

	FY 2001	FY 2000	FY 1999	Seasoning Req Hrs/Mo)
Inexperienced Pilots				
C-5	28.3	26.0	30.5	30.0
C-141	24.9	22.6	33.4	29.0
C-17	32.0	28.7	33.6	35.0
C-130	21.2	19.6	25.5	29.0
KC-135	23.5	23.2	30.1	25.0
KC-10	22.1	22.4	35.5	29.0
Experienced Pilots				
C-5	22.4	20.7	26.9	N/A
C-141	24.0	22.7	31.1	N/A
C-17	29.2	28.1	33.6	N/A
C-130	21.8	20.6	24.2	N/A
KC-135	20.7	20.4	27.8	N/A
KC-10	21.2	21.6	31.1	N/A

Integral to this argument is how pilots log hours in mobility aircraft. The current AMC accounting rule for meeting aircrew seasoning requirements is that each pilot aboard a flight receives credit for all the flying hours logged during the flight regardless of the number of the pilots on the crew (USAF, 2010). Since all pilots onboard a mobility aircraft may log flying hours towards total time, unit commanders and operation's officers must delicately balance seasoning against the quality of training per crewmember. As much as it is desirable to increase the number of pilots on board to secure seasoning hours, it comes at a cost in decreasing quality of training per aircrew member. That is the quality of actual hands on training and seasoning per flyer decreases because the time at the controls is divided up between all the pilots on board. Thus, operation's officers and commanders have to effectively manage the quality training versus the total seasoning per crew member. Striking the correct balance between these two areas is important because individual pilot flying abilities and decision making develop at varying rates (Endsley & Robertson, 2000). That is Commanders may have to provide more quality hands on seasoning and training opportunities to pilots who struggle in development compared to those who do not.

In 2003, through project Air Force, RAND made a recommendation to AMC that the C-17 community should take advantage of its longer average sortie durations (4 plus hours) and increase seasoning time per crewmember by ensuring a minimum of 2 inexperienced pilots are scheduled for training and operational sorties (Chow, 2003). This becomes extremely critical and beneficial to the flying austerity argument because it enables AMC to maximize seasoning per crew member per sortie, without seriously degrading the quality of training per crewmember. Additionally, it provides unit

leadership with options for managing the perishable seasoning hours and ensuring uniform spread of opportunities as a seasoning additive in the future.

The Flying Hour Program

To understand how the flying hour model works, let's start with the basics and explore the programming aspect performed at AMC. Before the beginning of a fiscal year, AMC submits a Flying-Hour Program (FHP) to Congress for appropriation. The FHP is managed and developed by the AMC/A3 Directorate. These programmed flying hours reflect the number of hours needed during the coming fiscal year to meet AMC pilot's seasoning and proficiency requirements. AMC's goal is to program the minimum hours necessary for training during peacetime to ensure our mobility forces are capable of proficiently meeting wartime mobility requirements as defined by the Air Force Joint Minimum-Essential Task List or AFJMETL (AMC/A3T, 2013).

Using the AFJMETL allows AMC/A3T to base the programming argument on the fact that time generated by the flying hour models will ensure AMC crews are trained to meet the wartime requirements today and sustain our force for the future. Since future readiness depends on AMC building the future warfighters for tomorrow, the command must build in and program a seasoning additive into the flying hour projections.

AMC calculates the seasoning additive as an overall hourly number across the entire mobility air force and refers to it as an aging rate. The aging rate is the number of hours per month across AMC that inexperienced crewmembers must log to meet required flying hours set by AMC to ensure upgrades, follow-on assignments, and force structure are maintained. It is important to point out that the terms experiencing, aging, and

seasoning are synonymous. Equation 1 posted below is the aging rate formula utilized in fiscal year 2013 to 2018.

$$Aging\ or\ Seasoning\ Rate = \frac{[MAF\ UPT(AF)\ X\ EXDEF\ (MDS\ VOL\ 1s)]}{Force\ (MAF\ API\ 1s)\ X\ \%INX\ X\ 12} \quad (1)$$

$$Aging\ or\ Seasoning\ Rate = \frac{490\ X\ 508}{2248\ X.43\ X\ 12}$$

$$Aging\ or\ Seasoning\ Rate = 22.2\frac{Hours}{Month}$$

Variables Defined
MAF UPT (AF): Expected Mobility Air Force Hires from UPT (Active Duty)
EXDEF (MDS VOL 1s): Experiencing hours definition Mission Design Series Volume 1
FORCE (MAF API 1s): Total primary flying duty billets across MAF
% INX: Inexperienced pilot ratio; always .43
12: 12 months per calendar year.

Equation 1: Seasoning/Aging Rate FY 13-18 (AMC/A3T, 2013)

The flying hour model utilizes the authorized force structure (i.e. primary mission aircraft inventory and crew ratios) to calculate the required hours per month for seasoning AMC's inexperienced pilots (AMC/A3T, 2013). The first part of the monthly flying hour program are hours earned to meet training table events and are calculated and funded as training operational and mission or O&M hours. O&M hours include test and ferry, local training, Joint Air Army Airborne Training (JA/AAT), Red Flag, and Weapons Instructor Course (WIC) support. These are the must train items and events required to meet the combatant commander's capabilities and requests for support.

The second part of the flying hour program is the Transportation Working Capital Fund or TWCF hours that are added to the "must train" O&M hours (AMC/A3T, 2013). TWCF hours include channel, Special Assignment Airlift Mission (SAAM), and Joint Chiefs of Staff (JCS) exercise support. The TWCF hours are added in after the O&M

hours as a supplement to meet the seasoning and experiencing goals. By regulation, AFI 11-102, paragraph 2.4 states "Flying hour calculations must include a seasoning (aging) calculation" (USAF, 2011).

The aging calculation accounts for both training and seasoning within a given mission design series and is designed to ensure inexperienced pilots meet the experiencing timeline for a given mobility community. Table 2 below provides a fiscal year summary of how active duty C-17 hours are programmed across the various O&M and TWCF mission sets to ensure a wide variety of seasoning is built into the crew force.

Table 2: Funding Flying Hours Summary FY 13-18 (AMC/A3T, 2013)

Fiscal Year	2012	2013	2014	2015	2016	2017	2018
Aging (Hours/Month)	**25**	**22.2**	**22.2**	**22.2**	**22.2**	**22.2**	**22.2**
O&M (Hours)							
Test & Ferry	504	678	528	504	796	496	496
Local Training	14,521	15,008	15,008	14,616	14,362	14,362	14,362
JA/ATT	4,664	4,664	4,664	4,664	4,664	4,664	4,664
Red Flag	114	114	114	114	114	114	114
WIC	1,300	1,300	1,300	1,300	1,300	1,300	1,300
O&M TOTAL	**21,123**	**21,764**	**21,614**	**21,198**	**20,936**	**20,936**	**20,936**
TWCF (Hours)							
Channel	54,480	46,797	46,887	45,016	43,867	43,867	43,867
SAAM	27,240	23,399	23,444	22,508	21,934	21,934	21,934
JCS Exercise	9,080	7,799	7,814	7,503	7,311	7,311	7,311
TWCF TOTAL	**90,800**	**77,995**	**78,145**	**75,027**	**73,112**	**73,112**	**73,112**
PROGRAM TOTAL	**111,923**	**99,759**	**99,759**	**96,225**	**94,048**	**94,048**	**94,408**

As a fiscal year progresses, AMC/A3T monitors program execution and makes adjustments during the fiscal year to maximize training accomplishments. If they find additional hours are required, AMC will create and submit requests to the Air Staff for approval and funding (AMC/A3T, 2013). Figure 2 is an illustration of the TWCF and O&M hour makeup for the active duty C-17 flying hour program during fiscal year 2013.
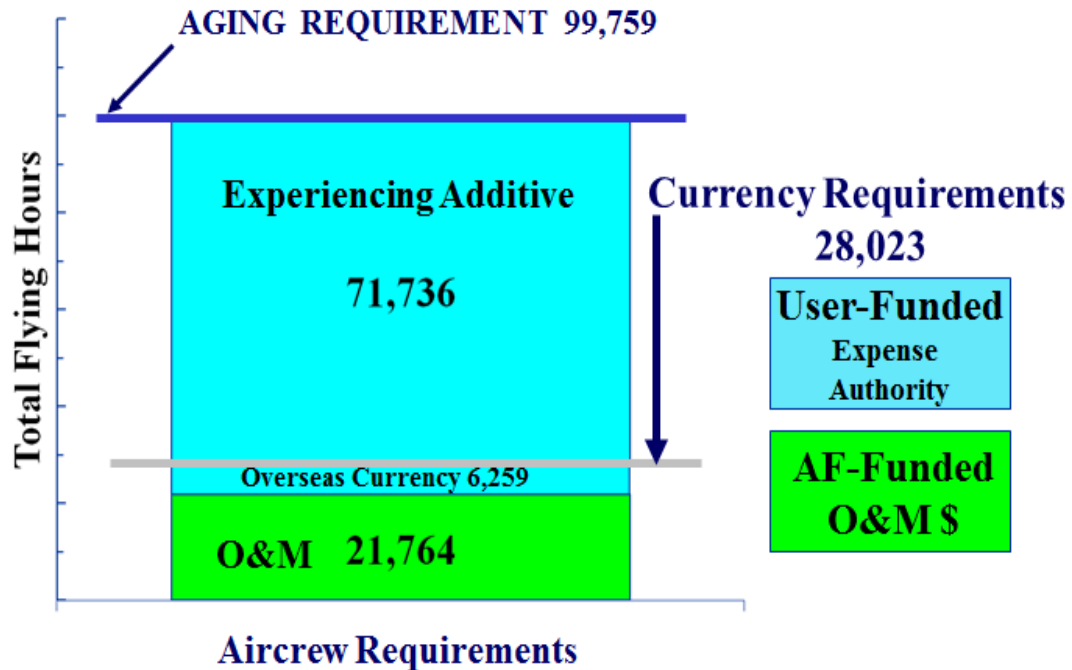
Figure 2: C-17, 2013 Active Duty Flying Hour Program (AMC/A3T, 2013)

It is important to point out the hours are programmed and are a mathematical

representation of the hours required. The execution of the program is less rigid because

in many cases, the O&M funded hours may not be met. The same relationship is true in

the TWCF realm, where Combatant Commander's requirements may not generate the

required number of TWCF hours needed to meet the seasoning goal. In this case, AMC

may try and supplement the TWCF hours by generating missions from its Operational

Train and Equip (OT&E) budget to meet the seasoning rates. To reduce the O&M

burden over the last decade AMC has moved a significant number of training

requirements to the simulator, thus enabling crew members to secure valuable seasoning

hours in the simulator. This enables AMC to reduce the size of the O&M budget because

training events are accomplished within the simulator rather than in the jet.

To demonstrate this evolution and transfer from the aircraft to the simulator, in FY 2001 the seasoning or aging requirement for C-17 pilots was 35 hours per month and in 2014, a mere 13 years later it has been reduced to 22.2 hours per month (AMC/A3TA, 2012). In 2007, in an effort to reduce flying hour costs AMC began moving training events to simulators, thus enabling inexperienced pilots to secure a portion of their training outside the aircraft. Simulator hours are credible towards total aircraft time and contribute to meeting upgrade seasoning hour goals (USAF, 2011). Moving training events to the simulators has helped reduced O&M budget and further efficiencies are possible by increasing the number of inexperienced pilots receiving training and seasoning on O&M allocated sorties.

This brings us full circle and demonstrates that throughout history the Air Force has struggled to meet aircrew seasoning requirements. Notably, there is not an established accounting method to match assets flown (i.e. tails) to a seasoning requirement. Rather, the Air Force continues to this day to utilize a flying hour program that is rarely fully allocated and funded. This is due to the fact that it is a programming tool and not based on assets actually flown and billed (Thaler & Dahlman, 2002). One of the main goals of the flying hour program is to establish the baseline aging rate to ensure AMC can allocate resources to meet the both the training and seasoning objectives per year.

Commander Air Force Forces Apportionment and Allocation Process (CAAP)

The Commander Air Force Forces (COMAFFOR) Apportionment and Allocation Process better known as CAAP is AMC's latest breakthrough in asset generation, a

system that has had a somewhat troubled history. In November of 2000, AMC developed the Aircrew and Aircraft tasking System better known as ATTS as its first allocation and tasking system. AATS was troubled from the start, primarily because of its inability to formally apportion between Combatant Commander and OT&E requirements (AMC/A3O, 2012, p. 2). Rather, AATS attempted to emphasize training and future engagements by generically setting a desired goal of 30% average crewmember availability to the Tanker Airlift Control Center (TACC) (AMC/A3O, 2012, p. 2). This became troublesome as surge and contingency operations became the normal day-to-day ops-tempo as Operation's Iraqi Freedom and Enduring Freedom became long-term conflicts.

On September 11th 2001, AMC had to suspend AATS and began surging crewmember availability from 50 to 73% on average to TACC (AMC/A3O, 2012, p. 2). From April of 2002 to June of 2003 the AMC asset generation system underwent several name changes from "Contingency AATS to MAX Surge back to Contingency AATS" as the shifts in weight of effort to the Combatant Commander were driven by changes in the operating environment and AMC/CC's assessment of needed apportionment (AMC/A3O, 2012, p. 2). Over AATS' troubled tenure, the realization became apparent that AMC required an asset generation system that balanced risk and included both apportionment and allocation in meeting both the Combatant Commander's and OT&E requirements.

After a decade of revising AATS, today's version of CAAP came about in July of 2012 to formally align the allocation process with the COMAFFOR's assessment of the current operating environment and national security objectives impacted by the Mobility Air Forces (AMC/A3O, 2012, p. 2). CAAP enables AMC to balance risk among the

apportionment of C-17 tails between maximum support to Combatant Commanders during war versus the ongoing OT&E requirement which focus on training, seasoning, and readiness for future engagements.

As CAAP desires to balance risk between Combatant Commander and OT&E requirements, it necessitated a requirement for monthly Commander's Intent and Planning Guidance (CIPG). CAAP was AMC's first attempt to create a common operating picture through layered involvement that balances risk with the Combatant Commander's and MAJCOM OT&E requirements as illustrated in Figure 3.
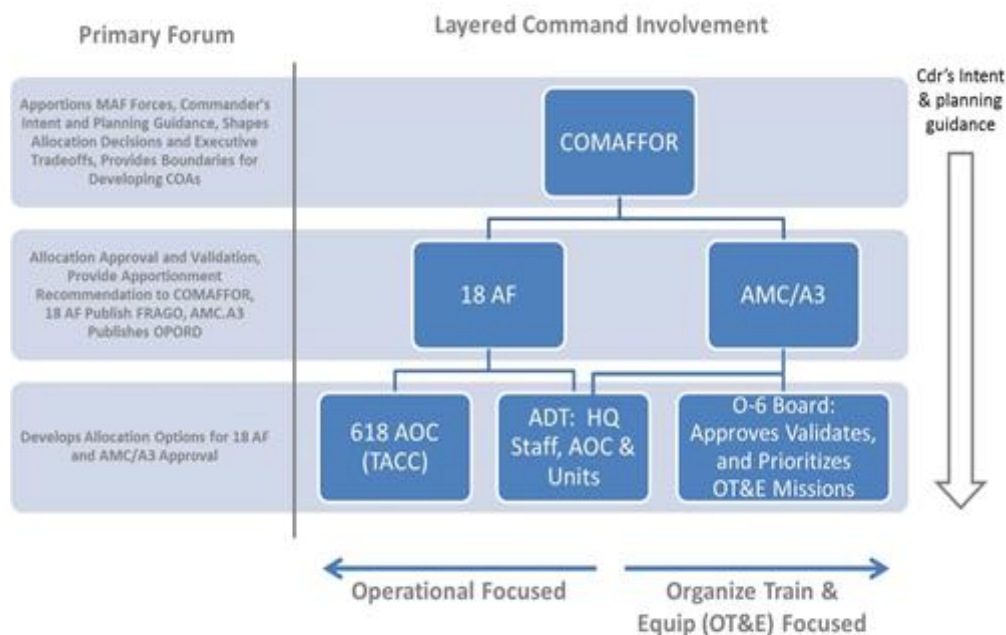
Figure 3: CAAP Layered Command & CIPG (AMC/A3O, 2012, p. 16)

The final approved allocation incorporates the CIPG and enables AMC to sustain global mobility and readiness in support of future Combatant Commander's mission requirements. As of the writing of this document, the CIPG is not a formal document,

but verbal guidance shared at the beginning of the allocation cycle and based on approval from previous allocation cycles or amended as needed by the AMC/CC.

The allocation period for the established CIPG covers a calendar month as each month's allocation periods is viewed as a separate yet connected link to the months preceding and following the cycle. Furthermore, the allocation periods are developed out to a planning horizon, which is defined as the point where requirements first come into view with sufficient clarity to begin shaping future allocations, normally 30 to 180 days (AMC/A3O, 2012, p. 9). The value in looking out to the planning horizon provides the allocation cycle a tempo even if the fidelity of the requirements is unknown and may differ between mission sets. As the fidelity of the requirements becomes more solid, the tempo and rhythm provide insight into how future allocations will affect various AMC airlift and air-refueling platforms. It provides an opportunity to look for potential shortfalls or develop alternate courses of actions to stabilize the future cycles and manage risk.

The allocation cycle contains 5 critical elements: assessment, development, approval, communication, and execution and is illustrated in Table 3 (AMC/A3O, 2012, p. 6). However, the assessment and development elements are arguably the most critical from a future readiness and planning perspective since the approval, communication, and execution elements are follow-up stages with little to no impact on initial planning.

Table 3: Allocation Cycles to Planning Horizon (AMC/A3O, 2012, p. 30)

Execution	Allocation Recommendation (Development, Approval)		Allocation Refinement, Issue Identification/Resolution & Shaping Activities			Initial Allocation	The Planning Horizon
Current Month	Current + 1	Current + 2	Current + 3	Current + 4	Current + 5	Current +N	
Active FRAGO	DRAFT UAL	DRAFT UAL	DRAFT UAL	DRAFT UAL	DRAFT UAL	DRAFT UAL	

N = month number

UAL = Unit allocation

FRAGO = Fragmentary order

 The first step of assessment involves collecting the data necessary to forecast, design, and assess total requirements, available capacity, and the status of the crew and aircraft fleet. However, the capacity is useless unless we have the matching requirements to fill. The requirements fall into three prioritized and established bins for allocation: Combatant Commander (CCDR), Major Command (MAJCOM), and Unit as illustrated in Figure 4 (AMC/A3O, 2012, p. 14). Once the requirements are known, they can be apportioned and allocated.
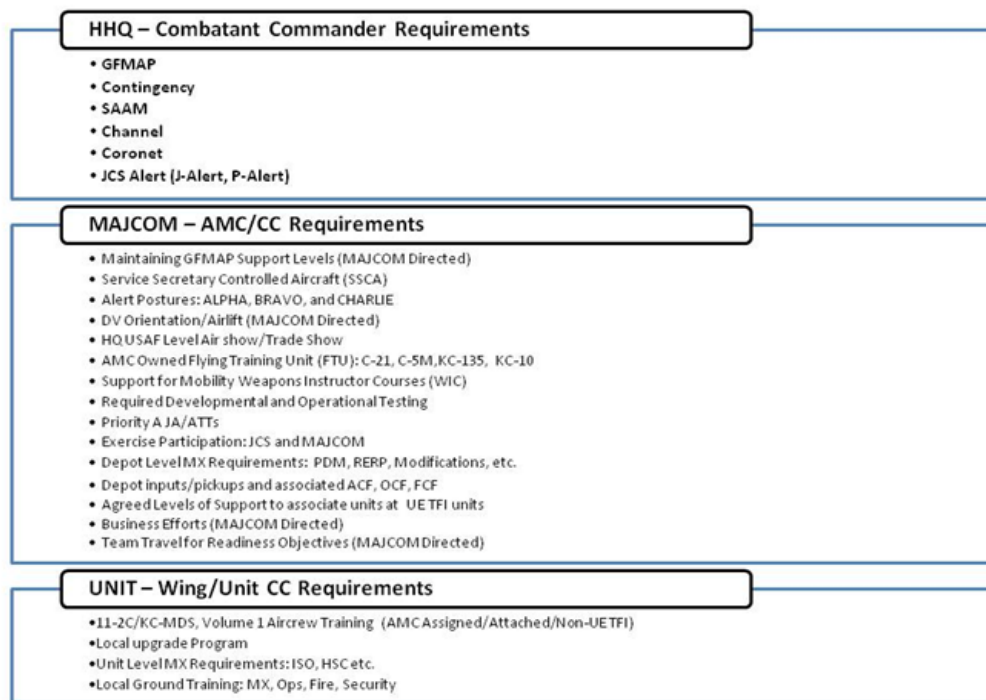
Figure 4: CAAP Requirement Bins (AMC/A3O, 2012, p. 38)

AMC/A3O aggregates and compiles the data form a variety of sources and works with the Allocation Development Team (ADT) to begin the second phase of development. The development element begins when the ADT utilizes the CIPG to develop an allocation plan for each calendar period, dividing requirements into Combatant Commander and OT&E bins dictated by mission set.

The development process attempts to capture the capacity of crews and tails and match them to requirements per period to determine if any potential risk may be assumed by the COMAFFOR. The development process allows members of their respective ADT team to voice concerns and annotate risk associated with the collaborated effort. It is important to note that the OT&E bin contains both MAJCOM and unit requirements that may be at risk depending on the final allocation. The OT&E function becomes the vector

in generating the minimum range of tails for sorties via CAAP to meet the programmed seasoning rates per MWS. In the absence of combatant commander requirements, AMC has an OT&E responsibility to season aircrews and ensure the force is trained and ready when the nation calls.

During the development phase, the ADT focuses on understanding the entire set of requirements across all three bins during an allocation period and develops an allocation strategy that satisfies the commander's intent while meeting as many requirements as practical (AMC/A3O, 2012, p. 16). The ADT is an "integrated planning team comprised of representatives from AMC, AFRC, ANG, 18 AF, 618 AOC (TACC) and units from AD, ARC, USAFE and PACAF based on mission set" (Tanker, Strategic Airlift, and Tactical Airlift) (AMC/A3O, 2012, p. 9). Commanders and Operations officers at all levels and within all communities are requested to participate in the ADT to keep the process as transparent and as viable as possible. For example, if a unit wants to perform an off station operational readiness exercise, these unit requirements need to be filtered to ADT so they can be accounted for and allow a balancing of requirements within the allocation. Figure 5 is visual depiction of the various organizations comprising a potential ADT.
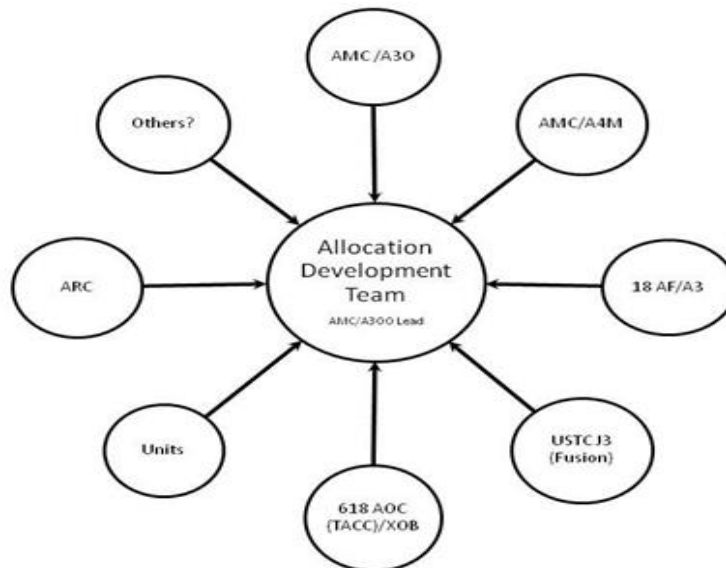
Figure 5: CAAP Allocation Development Team Example (AMC/A3O, 2012, p. 9)

AMC/A3O leads the ADT through the allocation and planning process and provides the necessary conduit for commanders to communicate intent and specific planning guidance between various players. For example, AMC/A4 provides the command maintenance perspective in regards to options of the fleet management in terms of tails available for a given allocation period. Additionally, individual active duty units may provide confirmation of tail availability and available crew information as well as any specific unit requirements. Other agencies such as the TACC and TRANSCOM Fusion cell may also participate and provide special requirements to an ADT for a given allocation period.

The ADTs are broken up into three separate but connected ADTs: strategic airlift, tanker, and tactical airlift (AMC/A3O, 2012, p. 9). It is imperative to point out ADT's are the critical link between the AMC staff and directorates with the unit commanders and operations officers. Their main purpose is to create fidelity, transparency, and viable

options within the process for AMC leadership to act on (AMC/A3O, 2012, p. 10). Vital in meeting the CAAP objectives, ADT success depends on maximum participation and a free flowing conduit for communication of information both horizontally and vertically among members.

One can argue the ADT sits at the heart of CAAP's future success or failure since CAAP attempts to provide better informed allocation recommendations, reduce turbulence in the global mobility system, and extend and improve requirements forecasting. The desired end state, as stated by General Robert Allerdice at the CAAP's conception, is to "improve predictability and stability for efficient scheduling of MAF assets and to meet the Air Mobility Command's call to arms" (Allerdice, 2012, p. 2). As the allocation process is developed, it enters its final three phases: approval, communication, and execution.

After the assessment and development elements are complete, the apportionment briefing is prepared by the respective ADT as means to secure COMAFFOR approval of the proposed CCDR and OT&E apportionment level and provide a status update for future plans (AMC/A3O, 2012, pp. 31-36). The briefing is presented to AMC/CC who is acting as the United States Transportation Command's COMAFFOR. However, the final allocation decision authority is delegated to the 18th Air Force Vice Commander (18 AF/CV) and AMC Operations Directorate (AMC/DA3), who represent Combatant Commander and OT&E interests respectively (AMC/A3O, 2012, p. 5). Decisions are made jointly, however in the rare case of a disagreement the final decision will be elevated to AMC/CC for a final decision.

The standard briefing cycle is monthly, normally in the first week of a given month and the participants provide inputs through their respective ADT. The briefing is staffed through the 18 AF/CV and AMC/DA3 for approval and serves as a forum to update the CIPG to be used during subsequent allocation decisions and execution (AMC/A3O, 2012, p. 35). AMC/A3O serves as the office primarily responsible for disseminating, developing, and presenting the approval brief.

For example, the approval apportionment briefing in Figure 6 shows a fused requirements picture. The fused requirements picture identifies the total capacity required to meet all known requirements. Additionally, the fused pictures enables the AMC/CC to allocate between bins to best meet the spread of requirements during a given allocation period (AMC/A3O, 2012, p. 32).
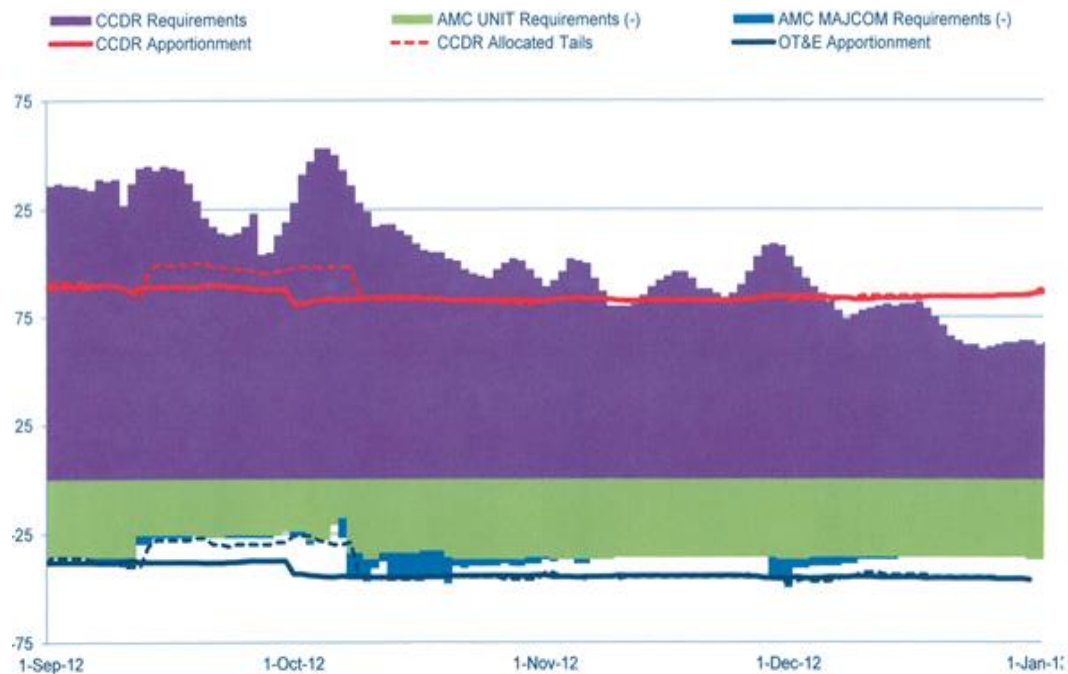
Figure 6: CAAP Apportionment Briefing (AMC/A3O, 2012, p. 32)

Figure 6 shows the highest priority requirements for OT&E and CCDR bins near the middle (zero) and lower priority trade space near the edges (top and bottom). This is one possible view that would bring the total requirements level within the capacity lines (shown in purple). Figure 6 assists one in visualizing the ebb and flow of requirements over time and identifying potential shortfalls, conflicts, and lulls during which additional CCDR, MAJCOM, or Unit requirements could be allocated (AMC/A3O, 2012, p. 36). After approval, the allocation is communicated via the Secret Internet Protocol Router Network (SIPRNET) and sent to the units as a Fragmentary Order (FRAGO).

The final phase is executing the allocation, which is performed by the 618th Air Operations Center (AOC) also known as the TACC and the units themselves. The allocation is executed by the 618th AOC and the mission wings, which fly the allocated tails, thus completing the CAAP cycle. From assessment to execution, CAAP attempts to strike a balance between Combatant Commander Requirements and the necessary OT&E functions for crews and tails. In the end, CAAP is AMC's first attempt to balance risk while effectively and efficiency matching tails to requirements. CAAP is arguably the missing link in accounting and allocating assets flown (i.e. tails) to an established seasoning hour requirement set forth in the flying hour program.

Reasoning Behind Minimizing Training & Seasoning Flying Hours

In June of 2013, the Government Accountability Office released a report titled the "DoD needs to take steps to manage workload distribution to the Civil Reserve Air Fleet (CRAF)" (USGAO, 2013, p. 2). In their report to congressional committees, the GAO asserts the DoD has exceeded the flying hours needed to meet military training and

seasoning requirements for fiscal years 2002 through 2010 and in doing so failed to meet stipulations set forth in the National Airlift Policy and DoD instructions. Initially, the GAO report attributes the over flying to the massive increase in operational tempo associated with deployments to Operation's Enduring Freedom and Iraqi Freedom.

However after the initial deployment phase, the report highlights a concern that the DoD has failed during sustained contingencies to establish a process for monitoring flying hours based on tails allocated and flown in order to meet the minimum training and seasoning requirements (USGAO, 2013, pp. 26-30). Such a monitoring process is vital to determining the point at which DoD training and seasoning requirements are met while shifting excess requirements to the Civil Reserve Air Fleet since over flying assets can be detrimental to the long term health of the fleet and is in violation of national policies.

The GAO report points out an interesting and long term problem. As suggested earlier, the DoD has failed to establish a process that monitors airlift allocation to meet its training and seasoning objectives and distribute excess workload to the Civil Reserve Airlift Fleet. The National Airlift Policy states "The goal of the United States Government is to maintain in peacetime organic military airlift resources, manned, equipped, trained and operated to ensure the capability to meet approved requirements for military airlift in wartime, contingencies, and emergencies" (Reagan, Ronald, 1987). It can't be overstated, that "minimum utilization rates shall be established within the Department of Defense" which will provide for levels of operation and training sufficient to realize this goal (USGAO, 2013, p. 6). The DoD does not want to sacrifice the health of the fleet and the long term viability of organic airlift, as all airplanes have a programmed flying lifetime.

To maintain a viable fleet and in support of the National Airlift policy, the GAO report points out DoD Instruction 4500.57 requires that DoD operate its fleet to meet its training requirements and also requires that it use commercial sources of transportation to the "maximum extent practicable" (DODI, 2008, p. 4). However, since the DoD does not have a process currently established to monitor the tail allocation requirements that meet both training and seasoning requirements, the DoD does not know when to shift eligible airlift missions to CRAF participants. Therefore, the DoD fails to ensure that commercial sources are used to the maximum extent practicable, as required by DoD guidance. It is safe to assume without a process that matches tails to training and seasoning requirements that AMC is flying the organic military fleet and crews unnecessarily beyond the minimum requirements. This may become critical in any future environment where excess requirements exist.

As previously noted, DoD guidance requires TRANSCOM to meet its training needs while also using commercial sources of transportation to the maximum extent practicable. However, the GAO report states "DoD officials told us that meeting training needs is their priority, and flights provided by CRAF participants are less expensive than military flights, in part because commercial aircraft are designed to be more fuel-efficient, while military aircraft are designed to carry heavy cargo and land in austere locations" (USGAO, 2013, p. 17). Therefore, once AMC has met the organic fleets training and seasoning requirements, the report suggests that excess capability shifted to commercial carriers will be less costly in the long run. For example, according to an April 2013 analysis provided by AMC officials, the cost per pound to transport cargo using commercial carriers, such as the 747 and MD-11, can be between 22 and 35 percent

lower than the cost of transporting the same cargo using military aircraft, such as the C-5 and C-17 (USGAO, 2013, p. 19). However, for this to be cost effective, TRANSCOM and AMC must continuously monitor the process and know at what point training and seasoning requirements are met to ensure excess is shifted.

TRANSCOM does perform periodic monitoring and distribution of missions between military and commercial sources. However these periodic reviews do not consider the extent to which seasoning and training requirements have already been met or will be met based on future requirements. As of the writing of this paper, no process exists to monitor aircrew training and seasoning rates by unit based on tails allocated by AMC. Secondly, the CRAF carriers cannot fly all the airlift missions as some airlift missions have driving requirements or features that require military airlift. For example, missions that require military escorts, special handling, or destinations with unpaved runways will require military airlift and will not be eligible for CRAF execution.

In the end, it's critical DoD, TRANSCOM, and AMC start on the same page. Each agency, must have a clear understanding of the number of hours and tails required to meet seasoning and training requirements—and use the information to shift excess eligible airlift missions to CRAF participants. (USGAO, 2013, p. 35). This requires a process that monitors airlift allocation by tail to meet training and seasoning objectives and distribute excess workload to the Civil Reserve Airlift Fleet. Essentially, AMC has to know how many tails per day are required to be allocated to ensure training and seasoning requirements are met. Assuming an estimated range of C-17 tails can be determined to meet seasoning rates and flying austerity comes to fruition, AMC can leverage CAAP to predict its internal demand and allow the DoD to use commercial

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transportation to the maximum extent practicable as required by regulation if and when excess requirements exist.

Summary

As discussed in the literature review, over the last decade airlift has been at a premium and provided AMC the ability secure valuable seasoning, development, and experiencing hours for C-17 pilots while simultaneously meeting our nations call to arms. As our Nation's C-17 force returns to a peacetime posture and airlift demand slows, AMC will need a flexible asset generation system to make predictions about tail allocations. An unpredictable future means AMC will depend on the CAAP to ensure future C-17 unit allocations are distributed in a manner to meet all training and seasoning goals, thus shifting any excess requirements to incentivize the CRAF and maximize use among commercial partners as directed by regulation. The resulting flying austerity combined with future fiscal challenges will force AMC to generate and fly C-17 tails in support of seasoning goals. The research methodology proposed in the next chapter will be the first of its kind in attempting to correlate C-17 tail allocation against a calculated seasoning rate to mitigate the adverse effects of potential flying austerity.

"All models are wrong, some are useful" – George Edward Pelham Box

Chapter Overview

  This chapter discusses the three phase qualitative case study approach, focusing on the deductive logic and quantitative data analysis employed during the study. The objective is to clearly discuss how the methodology was employed in each of the three phases. Recall from the introduction, phase one is the historical analysis and evolution of the AMC tail appropriation and allocation process, as well as the external factors that affect the process. Phase 2 is the analytical analysis of sorties flown among 11 active duty units from January to July 2013. In phase 2 the research focuses on mathematically finding the seasoning hour requirement and secondly determining the average training and mission sortie duration by unit during the aforementioned timeframe. Phase 3 culminates the research, synchronizing the analysis from Phases 1 and 2 in an attempt to estimate the minimum range of C-17 tails across the enterprise required to meet the targeted seasoning hours in both basic and augmented crews per tail.

  Recall, the goal of this methodology in its suggested 3 phase qualitative case study and quantitative analysis format is to solve the problem statement: How can Air Mobility Command estimate a range in minimum number of C-17 tails required to meet aircrew seasoning requirements given a prediction of future flying austerity.

Phase 1: Case Study focused on the AMC's Appropriation and Allocation Process

  If one is to estimate a minimum range in C-17 tails required to meet aircrew seasoning requirements, the logical first step is to fully study and understand how Air

Mobility Command has historically executed C-17 tail appropriation and allocation. Additionally, it's imperative to understand the external factors, programs, and regulations that influence the process.

Therefore, the analysis initially employs a case study approach to secure knowledge about the history and the current allocation processes employed. Researcher Robert K. Yin defines the case study research method as an "inquiry that investigates a current process within its real-life context, attempting to understand the event and/or process through constant review, participation and study" (Yin, 1984, p. 137). The case study approach was employed to create knowledge and share understanding of the tail allocation process employed at AMC as discussed in the literature review. The researcher in this case monitored and participated in numerous monthly Defense Connect Online (DCO) sessions to increase understanding and study AMC's process in action, from the AMC/CC to the unit level.

Secondly, the case study was designed to bring an understanding of complex issues by accounting for external variables and adding strength to what is already known through previous research (Yin, 1984, p. 138). External factors that put pressure on the tail appropriation and allocation process are vital to the study, and include the flying hour program, historical aircrew seasoning rates, future flying austerity predictions, and the adherence to DoD mandates in meeting readiness through minimum tail execution. As stated in the literature review, these are vital external factors that shape and mold the C-17 tail appropriation and allocation process.

Phase 2: Seasoning Rate Development and Unit Duration Data Analysis

In phase 2 the research focuses on mathematically deriving an equation to meet

the seasoning hour requirement and secondly determining the average training and

mission sortie duration among C-17 active duty units from January to June 2013. As

discussed in the literature review, AMC/A3T already computes a very general mobility

aging rate across the enterprise as an executive management tool for programming flying

hours. However, to compare AMC/A3T's seasoning rate to a specific C-17 seasoning

rate among the 11 active duty units studied, it is necessary to list some basic assumptions.

Seasoning Rate Development Assumptions

1. To keep the ratio of .43 inexperienced pilots to .57 experienced pilots constant
   among the 11 active duty units studied, flow out of the C-17 community will
   equal flow in. Historically, AMC/A1 and AFPC indicate this inflow and outflow
   to be approximately 14 pilots per year per unit (AMC/A8PF, 2013).

2. To become eligible for upgrade C-17 pilots must accrue 1000 total hours, and for
   this analysis it's assumed all pilots will graduate UPT with 200 hours and secure
   an additional 200 hours in simulator time as an inexperienced pilot. Therefore,
   the experiencing definition will be set at 600 hours.

3. Unit commanders and operations officers will effectively monitor flying hours to
   ensure inexperienced pilots also receive 400 hours of primary time before
   becoming experienced pilots, and ensure scheduling to upgrade pilots within the
   normal 24 to 36 month timeframe.

4. Attached pilots are considered outside the scope of this study and are not captured
   in the analysis, only the core pilots within the unit.

   Applying the above assumptions and molding them into the AMC/A3T aging

formula creates the following seasoning equation. It's important to note the seasoning

rate calculated in Equation 2 is in hours per month and is for comparison purposes only.

$$\begin{aligned}
&\textbf{\textit{Seasoning Rate}} \\
&= \frac{(\textbf{\textit{Flow in Per Unit}} \; \times \# \; \textbf{\textit{units}}) \times (\textbf{\textit{Upgrade Hrs}} - \textbf{\textit{Accrued hrs}})}{(\textbf{\textit{Total Pilots}} \; \times \textbf{\textit{Inexp Pilot Ratio}} \; \times \; \textbf{12} \; \textbf{\textit{months per yr}})}
\end{aligned} \tag{2}$$

Equation 2: C-17 Specific Seasoning Rate (Hrs/Mo) for 11 Active Duty Units

Average Training and Mission Duration Calculations

The next step in phase two is to analyze and cross check the data from the various

AMC sources in an effort create data sheets specific to individual units. It is imperative

to understand the differences in execution of tails at the unit level in meeting both

training and seasoning objectives. All training and mission-related data evaluated in this

study was collected from 11 Air Mobility Command active duty C-17 units, detailing the

period from January to June 2013. The units and their respective locations are listed in

Table 4. The target parameter to measure seasoning was the inexperienced pilot as

discussed in the literature review.

Table 4: C-17 Active Duty Units and Locations Studied

C-17 (Active Duty Force)	
AMC	**UNIT**
TRAVIS, CA	60 AMW/21 AS
MCCHORD, WA	62 AW/10 AS
MCCHORD, WA	62 AW/4 AS
MCCHORD, WA	62 AW/7 AS
MCCHORD, WA	62 AW/8 AS
MCGUIRE, NJ	305 AMW/6 AS
DOVER, DE	436 AW/3 AS
CHARLESTON, SC	437 AW/14 AS
CHARLESTON, SC	437 AW/15 AS
CHARLESTON, SC	437 AW/16 AS
CHARLESTON, SC	437 AW/17 AS

Assumptions

There are several assumptions that need to be clearly understood before continuing the phase 2 analysis at the unit training and mission level. These assumptions remain valid for phase 3 as well.

1. All of the C-17 data provided by AMC/A1, AMC/A9, 618 AOC/XOND, and individual units may have human data entry error, these are deemed negligible to the overall analysis.

2. Air Mobility Command will man units at 100% pilot manning based on Force Structure and crew ratios. All experienced attached pilots are considered outside the scope of the analysis for seasoning. For example, Primary Mission Aircraft Inventory (12 aircraft per unit) and crew ratios (3.0 per aircraft) will not change.

3. Individual unit's tails will fly no more than one sortie per day, and that sortie will be flown at the average training or average mission sortie duration determined via the analysis.

4. The researcher assumes an average of 30 days per month for both training and mission tail allocations during January through June 2013 timeframe.

5. Units co-located on the same station do not mix and match crews on training or mission sorties.

6. Units will schedule one inexperienced first pilot per tail when basic crew compliment is evaluated. No more than two inexperienced first pilots will be scheduled per tail when augmented crew compliments are evaluated

7. The AMC/A3T aging/seasoning rate for fiscal years 2013 through 2018 is maintained constant at 22.2 hours per month as discussed in the literature review earlier.

Process

The data for this analysis was retrieved from AMC/A3T, AMC/A1, AMC/A9, 618 AOC/XOND, and from individual units during August 2013. The data encompasses all missions executed from 1 January 2013 until 30 June 2013. The first step was to filter the data, into the necessary areas of interest for the analytical analysis. The next step was to filter the entire dataset based on aircraft type to ensure only C-17 aircraft data points

are captured. At this point, individual data files were created and it was further filtered by operating organization and operating squadron. This way, the combined data sets were unit specific and included only data points owned and operated by the units listed in the aforementioned Table 4.

Each units data set was further filtered to contain only vital data points: mission identification, mission design series, tail number of aircraft, mission classification, operating organization, operating squadron, actual departure time (in Zulu), actual arrival time (in Zulu), and flight time in minutes. O&M funded missions were filtered based on classification; test and ferry, local training, red flag support, weapons school, and JA/ATT were filtered into a unit's training data set. Furthermore, TWCF missions were filtered based on classification; channel, SAAM, JCS Exercise, contingency, theater direct delivery, and airevac were filtered into a unit's mission data set for each of evaluated units.

Once initial filtering was complete, each unit's data set was crosschecked against 618th AOC/XOND data and individual unit data. This intermediate step was utilized to fill in missing information from the AMC/A9 GDSS data set. 618th AOC and the individual units were vital in filling some missing data points, however not all the missing data holes could be filled and data points missing vital pieces were removed from the final analysis and are indicated in the Table 5.

Finally, from the unit data sets both training and mission data sets were further filtered to eliminate data points that were not fully executed and had emergency returns. For example, any mission or sortie that had an immediate return to home-station for an inflight emergency was eliminated from the data set so it would not influence average

sortie duration per a given unit. Ultimately, this means the final range in numbers of tails

expressed in the results and analysis section is slightly conservative. However, the

removed data points were a small percentage of total hours and are deemed negligible to

the overall analysis.

The next step is to find the average training and mission sortie duration over the 6

month time frame per unit. Based on the aforementioned assumption that a unit tail will

fly one sortie per day, the researcher had to filter the data based on a 181 day Julian

calendar. The researcher studied C-17 tails executed from 1 January 2013 to 30 June

2013 (Julian days 1 to 181) in order to find the average sortie duration. Therefore, each

data set included a unit's average training sortie duration and mission sortie duration

based on tail number in minutes executed per Julian day. After filtering, crosschecking,

and filling in the holes between the training and mission data sets for each of the 11

evaluated units, the total number of data points was 10,894. In this case, each data point

was equal to a tail executed over the six month research window. Of the 10,894 data

points; 9,481 tails were TWCF mission data points and 1,413 tails were O&M training

data points.

The individual unit data sets were converted to flying hours by taking each data

points flying time in minutes and converting it to hours by dividing the durations by 60

minutes per hour. Secondly, to find an overall average during the 6 month period, each

unit's monthly total of hours was divided by 30 days per month as mentioned earlier in

the list of assumptions. Following this process provides the average training sortie and

average mission sortie durations in hours by unit listed in Table 5, concluding phase 2 of

the 3 phase analysis.

Table 5: C-17 Unit Analysis AMC/A9, 618 AOC, & Unit Data Sets

UNIT	Avg Training	Std Dev	Avg Msn	Std Dev	# Removed
60 AMW/21 AS	3.937804878	1.230755453	4.948363637	2.817633321	6
62 AW/10 AS	3.133428572	1.358936906	5.255910705	2.676510063	5
62 AW/4 AS	4.161842105	1.846606183	5.094288793	2.633524762	6
62 AW/7 AS	3.595588235	1.842370806	5.375572738	2.616873474	3
62 AW/8 AS	3.926388888	1.929191362	5.522698413	2.789563052	2
305 AMW/6 AS	4.15261708	1.430997788	4.46682243	3.154522913	6
436 AW/3 AS	2.32713964	1.591013454	4.029022557	3.067726942	4
437 AW/14 AS	2.844920635	1.734173899	4.142998205	2.858787106	4
437 AW/15 AS	3.346568627	1.371994184	3.970820105	2.811945513	3
437 AW/16 AS	2.968553458	1.713618531	3.557432432	2.486124389	2
437 AW/17 AS	2.9447861	1.629665952	4.572865497	3.230892123	1

Phase 3: Fusing Phase 1 and 2 into an AMC Tail Allocation

In the final phase it's necessary to synchronize the knowledge and analysis from phases 1 and 2 in an attempt to estimate the minimum range in number of C-17 tails per day for future allocations in meeting a targeted seasoning rate. With the average sortie duration determined, the number of inexperienced pilots per unit is needed, which will determine the seasoning hour requirement. To determine the number of inexperienced pilots per unit it becomes necessary to first know the existing force structure. The main parameters of interest are the Primary Mission Aircraft Inventory (PMAI) and the Crew Ratio (CR) per unit. Force structure data was gathered from AMC/A1 and AMC/A8PF: it is depicted in Table 6.

Table 6: C-17 Laydown by active unit with Crew Ratio (AMC/A8PF, 2013)

AMC	Unit	Aircraft Type	Crew Ratio	PMAI
Travis, CA	60 AMW/21 AS	C-17	3	12
McChord, WA	62 AMW/10 AS	C-17	3	12
McChord, WA	62 AMW/4 AS	C-17	3	12
McChord, WA	62 AMW/7 AS	C-17	3	12
McChord, WA	62 AMW/8 AS	C-17	3	12
McGuire, NJ	305 AMW/6 AS	C-17	3	12
Dover, DE	436 AMW/3 AS	C-17	3	12
Charleston, SC	437 AMW/14 AS	C-17	3	12
Charleston, SC	437 AMW/15 AS	C-17	3	12
Charleston, SC	437 AMW/16 AS	C-17	3	12
Charleston, SC	437 AMW/17 AS	C-17	3	12
Total	**11 Units**			**132**

Using deductive logic to determine the number of inexperienced pilots per unit, it's necessary to first determine the total number of pilots per unit based on the data in Table 6. To determine total pilots, take the PMAI per unit and multiply it by the CR and the number of pilots per C-17 crew (always 2; 1 Aircraft Commander and 1 Pilot). Thus, the Equation 3 is derived.

$$Total \frac{Pilots}{unit} = PMAI \times CR \times 2\ Pilots\ Per\ C-17\ tail \qquad (3)$$

Equation 3: Total Pilots Per Unit

As stated earlier, the analysis excludes attached pilots and assumes 100% pilot manning as force structure remains the same, so the PMAI and the CR are deemed constant. Also of note in Table 6 is the fact that the PMAI and the crew ratio for each of the 11 active duty units evaluated is 12 and 3 respectively. Therefore, the total number of pilots calculated per unit will be the same. Moreover, the same is true for the number of inexperienced pilots, assuming the AMC/A3T inexperienced ratio is held constant at .43. In order to find the number of inexperienced pilots per unit, take the total number of

pilots calculated and multiply it by .43 as directed by the AMC/A3T flying hour model. Therefore, Equation 4 is derived to determine inexperienced pilots per unit.

$$Inexp\frac{Pilots}{Unit} = Total\frac{Pilots}{unit} \times Inexp\ Ratio\ (AMC\ A3T) \qquad (4)$$

Equation 4: Inexperienced Pilots Per Unit

The next step in the analysis is to determine the number of training hours an inexperienced pilot accumulates per month that can be subtracted from total monthly seasoning requirement. As discussed earlier in the literature review and revisiting the assumption list above, AMC/A3T calculates the seasoning hour requirement at 22.2 hours per month for inexperienced pilots. It is important to note, the AMC/A3T rate is used in this analysis, but any rate can be substituted if a user desires to research a higher or lower rate in hours per month.

Revisiting the individual unit training data sets, one can multiply the average training sortie duration by the average number of training missions executed per month to determine the total number of training hours a unit accrues per month. Following this method, Equation 5 is created in hours per month.

$$Total\ Training\frac{Hrs}{Mo}$$
$$= Avg\ Traning\ Sortie\ Hrs\ \times \#\ Avg\ Training\ Sorties\frac{Ex}{Mo} \qquad (5)$$

Equation 5: Total Training Hours Per Month for a Given Unit

Next, the total training hours per month can then be divided by the total number of pilots per training tail to determine the number of hours subtracted from the monthly seasoning rate. Recall from the assumptions list, basic crew compliment assumes one inexperienced pilot per training tail and augmented crew compliment assumes two

inexperienced pilots per training tail. Therefore, applying this methodology, Equation 6 and Equation 7 are derived with unit's hours per month for all basic and all augmented crew compliments.

$$All\ Basic\ Training\ Hrs\ to\ Sub = Total\ Training\frac{Hrs}{Mo} \div 1\ Inexp\frac{Pilot}{Tail} \quad (6)$$

Equation 6: All Basic Crews Training Hours Per Month to Subtract

$$All\ Aug\ Training\ Hrs\ to\ Sub = Total\ Training\frac{Hrs}{Mo} \div 2\ Inexp\frac{Pilot}{Tail} \quad (7)$$

Equation 7: All Augmented Crews Training Hours Per Month to Subtract

Now, it is easy to take the monthly seasoning rate and subtract out the hours inexperienced pilots accrue per month flying training sorties. Performing some basic subtraction yields Equation 8; the number of mission hours remaining an inexperienced pilot must secure per month to meet the seasoning requirement.

$$Remaining\ Seasoning\frac{Hrs}{Mo}$$
$$= Seasoning\ Rate\frac{Hrs}{Mo} - Training\ Hrs\ to\ Sub \quad (8)$$

Equation 8: Remaining Seasoning Hours Per Month

It is now necessary to take the number of inexperienced pilots and multiply that by remaining seasoning hours per month a unit needs to fly to meet the established seasoning rate. This yields Equation 9, a unit's total number of mission seasoning hours per month required to augment the training hours in meeting the total monthly seasoning objective.

$$Total\ Mission\ Seasoning\frac{Hrs}{Mo}$$
$$= Remaining\ Seasoning\frac{Hrs}{Mo} \times Inexp\frac{Pilots}{Unit} \qquad (9)$$

Equation 9: Total Mission Seasoning Hours Per Month

Moving on, it is necessary to relate the total mission seasoning hours per month accrued to the number of mission tails required for generation and execution per month in order to achieve the remaining seasoning hours. To do this, take the total mission seasoning hours per month calculated above and divide it by the unit's average mission sortie duration from Table 5. Thus Equation 10 is derived, breaking down the total hours per month into mission tails executed per month based on average sortie duration per tail.

$$Msn\ \frac{Tails}{Mo} = Total\ Mission\ Seasoning\frac{Hrs}{Mo} \div Avg\ Mission\ Sortie\ Hrs \quad (10)$$

Equation 10: Mission Tails Per Month

Logically, the next step is to calculate the range of mission tails per month based on and the number of inexperienced pilots slated to fly per mission tail. Again, assume basic tails have one inexperienced pilot and augmented tails are limited to two inexperienced pilots per tail. Therefore, Equation 11 and Equation 12 are derived.

$$All\ Basic\ Msn\frac{Tails}{Mo} = Msn\frac{Tails}{Mo} \div 1\ Inexp\frac{Pilot}{Tail} \qquad (11)$$

Equation 11: All Basic Mission Tails Per Month

$$All\ Aug\ Msn\frac{Tails}{Mo} = Msn\frac{Tails}{Mo} \div 2\ Inexp\frac{Pilots}{Tail} \qquad (12)$$

Equation 12: All Augmented Mission Tails Per Month

The final step is to turn the tails per month into tails per day. However, it is necessary to account for both the training tails input and the mission tails input. To

determine the number of training tails per day a unit requires to meet its training needs; take a unit's average number of training missions executed per month and divide it by 30 days per month. In the case of all augmented tails, remember to include the all important factor that two inexperienced pilots are scheduled per tail. Doing the math in this manner will yield the number of training tails per day in both basic and augmented tails. The same is true for the mission tails. Take the mission tails per month in both basic and augmented and individually divide both by 30 days per month. Combining the training and mission tails per day inputs yields an individual units tail allocation. However, it's important to note the range of options in executing the allocation is given as the upper bound (All Basic tails) and the lower bound (All Augmented tails). Based on the previous discussion; Equation 13, Equation 14, Equation 15, Equation 16, Equation 17, and Equation 18, are derived with tails per day units.

All Basic Analysis (Upper Bound)

$$\textbf{Training}\frac{\textbf{Tails}}{\textbf{Day}} = \textbf{\textit{Avg Training}}\frac{\textbf{\textit{Sorties}}}{\textbf{\textit{Mo}}} \div 30\frac{\textbf{\textit{Days}}}{\textbf{\textit{Mo}}} \qquad (13)$$

Equation 13: All Basic Crews Training Tails Per Day

$$\textbf{\textit{Msn}}\frac{\textbf{\textit{Tails}}}{\textbf{\textit{Day}}} = \textbf{\textit{All Basic Msn}}\frac{\textbf{\textit{Tails}}}{\textbf{\textit{Mo}}} \div 30\frac{\textbf{\textit{Days}}}{\textbf{\textit{Mo}}} \qquad (14)$$

Equation 14: All Basic Mission Tails Per Day

$$\textbf{\textit{Total}}\frac{\textbf{\textit{Tails}}}{\textbf{\textit{Day}}} = \textbf{\textit{Training}}\frac{\textbf{\textit{Tails}}}{\textbf{\textit{Day}}} + \textbf{\textit{Msn}}\frac{\textbf{\textit{Tails}}}{\textbf{\textit{Day}}} \qquad (15)$$

Equation 15: All Basic Total Tails Per Day

All Augmented Analysis (Lower Bound)

$$\text{Training} \frac{\textbf{Tails}}{\textbf{Day}} = \text{Avg Training} \frac{\textbf{Sorties}}{\textbf{Mo}} \div (30 \frac{\textbf{Days}}{\textbf{Mo}} \times 2 \, \textbf{Inexp} \frac{\textbf{Pilots}}{\textbf{Tail}}) \quad (16)$$

Equation 16: All Augmented Training Tails Per Day

$$\text{Msn} \frac{\textbf{Tails}}{\textbf{Day}} = \text{All Aug Msn} \frac{\textbf{Tails}}{\textbf{Day}} \div 30 \frac{\textbf{Days}}{\textbf{Mo}} \quad (17)$$

Equation 17: All Augmented Mission Tails Per Day

$$\textbf{Total} \frac{\textbf{Tails}}{\textbf{Day}} = \textbf{Training} \frac{\textbf{Tails}}{\textbf{Day}} + \textbf{Msn} \frac{\textbf{Tails}}{\textbf{Day}} \quad (18)$$

Equation 18: All Augmented Total Tails Per Day

The final step is to analyze the data sets and apply Equation 3 through Equation 18 to calculate the tails per day for each of the 11 units. It is important to note, after calculating each units allocation to round off the final unit tail allocations to whole numbers since we can't fly .9 of a C-17 on any given day at any unit. This creates one final allocation of entirely whole numbers at the AMC level for monitoring, based on the aforementioned analysis. Thus, provides unit allocations in an all basic and all augmented crew compliments. This yields the AMC/CC an estimated minimum range in future C-17 allocations, which allows for potential decision options in meeting either a calculated seasoning rate or the established AMC/A3T programed rate in hours per month.

The AMC tail allocation is important, but arguably just as valuable is analyzing the calculated outputs against the compiled data set of executed C-17 tails. This becomes the thrust behind the final part of this methodology. Assuming a prediction of flying austerity equates to 100% of AMC's future tail allocations being O&M funded, one must

determine how many additional tails per year must be tasked. To do this, the research

makes an assumption that the baseline of O&M funded tails in FY 2013 will continue in

future fiscal years. Recall, that from the beginning of this chapter that 1,413 tails were

O&M funded over the six month period studied. Therefore, the researcher assumes that

in future years the baseline will be 1,413 tails per six months or 2,826 O&M funded tails

annually among the 11 active duty units.

To determine the additional tails AMC will have to supplement the baseline, the

researcher will subtract the O&M baseline tails from the total number of AMC tails.

Thus, the research will yield two potential supplements in completing the analysis: an all

basic upper bound and all augmented lower bound. Equation 19 and Equation 20 will be

utilized to determine the range of tails required to supplement the O&M baseline given

the prediction of flying austerity.

Upper Bound

$$Basic\ Supp\ \frac{Tails}{Year} = Total\ AMC\ Basic\ Tails\ \times 365\frac{Days}{Year} - 2,826\ Tails\ (19)$$

Equation 19: Basic Supplement Tails Given Prediction of Flying Austerity

Lower Bound

$$Augment\ Supp\frac{Tails}{Year}$$
$$= Total\ AMC\ Aug\ Tails\ \times 365\frac{Days}{Year} - 2,826\ Tails\ \quad (20)$$

Equation 20: Augmented Supplement Tails Given Prediction of Flying Austerity

Summary

Overall, the three phase qualitative case study approach proposed above focuses on employing deductive logic and data analysis to derive unit specific C-17 tail allocations. It requires basic deductive logic skills, arithmetic skills, and subscribes to a "keep it simple" philosophy as requested by the AMC/CC. The formulas are easily built into an Excel spreadsheet for data analysis, making most of the evaluation relatively quick and painless. Additionally, the data obtained for the analysis was freely obtained from AMC/A1, AMC/A9, GDSS, 618 AOC/XOND, and from individual unit sources. The methodology employed is simple, in providing the AMC/CC an estimated minimum range for future C-17 tail allocations. Finally, the supplemental analysis provides the AMC/CC some potential options to meet seasoning and readiness requirements in the event flying austerity comes to fruition.

IV. Analysis and Results

"Today's scientists have substituted mathematics for experiments, and they wander off through equation after equation, and eventually build a structure which has no relation to reality" – Nikola Tesla

Chapter Overview

The analysis was carried out using the previous chapter's methodology on each of the 11 active duty units. The final results are synchronized together to form a total allocation at the MAJCOM level by unit and provide the AMC/CC with a "glide-path" to monitor C-17 aircrew seasoning against total requirements executed. Additionally, in this chapter we will discuss the results of the six investigative questions posed in chapter one that necessitated this study.

Investigative Questions Answered

1. What process does Air Mobility Command utilize to apportion and allocate active duty C-17 missions at the Combatant Commander, Major Command, and Unit level?

As of July of 2012, Air Mobility Command utilizes the Commander Air Force Forces (COMAFFOR) Apportionment and Allocation Process to apportion and allocate active duty C-17 missions at the Combatant Commander, Major Command, and Unit level. As discussed in the literature review, CAAP provides AMC with a vital link between balancing risk among the apportionment between maximum support to Combatant Commanders during war versus the ongoing OT&E requirement to focus on training, seasoning, and readiness for future engagements.

The process is relatively complex, to formally align the allocation process with the COMAFFOR's assessment of the current operating environment and national security

objectives being impacted by the Mobility Air Forces (AMC/A3O, 2012, p. 5). CAAP

provides AMC with a vital link between balancing risk among the apportionment and

maximum support to Combatant Commanders during war versus the ongoing OT&E

requirement to focus on training, seasoning, and readiness for future engagements. Most

importantly as this research suggests, CAAP could be employed to monitor future

allocations in reference to an upper and lower bound that meets an established seasoning

rate.

2. What is the active duty C-17 pilot aircrew seasoning/aging requirement and
   how is it calculated?

As discussed in the literature review, AMC/A3T calculates a seasoning additive

as an overall hourly number across the force and refers to it as an aging rate. The aging

rate is the number of hours per month across AMC that inexperienced crewmembers

must log to meet the experiencing goals set by AMC to ensure upgrades, follow-on

assignments, and force structure are maintained. Utilizing Equation 1 for fiscal years

2013 to 2018, the following results are obtained.

$$\boldsymbol{Aging\ or\ Seasoning\ Rate} = \frac{[\boldsymbol{MAF\ UPT(AF)\ X\ EXDEF\ (MDS\ VOL\ 1s)}]}{\boldsymbol{Force\ (MAF\ API\ 1s)\ X\ \%INX\ X\ 12}}$$

$$\boldsymbol{Aging\ or\ Seasoning\ Rate} = \frac{490\ X\ 508}{2248\ X.43\ X\ 12}$$

$$\boldsymbol{Aging\ or\ Seasoning\ Rate} = 22.2\frac{\boldsymbol{Hours}}{\boldsymbol{Month}}$$

Variables Defined
MAF UPT (AF): Expected Mobility Air Force Hires from UPT (Active Duty)
EXDEF (MDS VOL 1s): Experiencing hours definition Mission Design Series Volume 1
FORCE (MAF API 1s): Total primary flying duty billets across MAF
% INX: Inexperienced pilot ratio; always .43
12: 12 months per calendar year.

A potential problem with this aforementioned equation is that it's not specific to a weapon system. It is inherently general, and each MAF weapon system employs specific mission capabilities that differ slightly from each other. Add in the fact that the crew ratio per weapon system differs and one can quickly conclude that the mobility aging rate formula is an executive level tool that uses the basic rated management math to drive the entire process. However, what one cannot conclude is how close is the MAF general equation in relation to a specific Major Weapon System (MWS) seasoning rate (i.e. C-17 specific rate). This is not saying the AMC/A3T aging rate is necessarily a bad equation or method to calculate the aging rate, but it's very general. The real question becomes what is the difference, since the programming of flying hours is based on this rate?

Through discussion with Mr. Craig Vara (AMC/A3T), "many more variables are required to derive an individual MWS rate," some of which are not easily attainable to create an exact calculation (Vara, 2013). Therefore some assumptions have to be made as discussed in Chapter 3. The real problem is the lack of forecasting, trending, and tracking where and how many pilots flow into and out of each AMC weapon system. Essentially, it's necessary to have a specific method or process to measure the exact inflow of inexperienced pilots and outflow experienced pilots per MDS, which currently does not exist.

Mr. Vara points out the primary pilot force structure constantly changes. Mr. Vara concludes AC upgrade "experience definitions" are normally revised and updated during AFI re-writes which changes the number of hours required for upgrade. Additionally, he points out the amount of programmed simulator time, planned assignment, and AC stability, (continental United States based or outside the continental

United States), and the number to be released early for duties such at UPT instructor

pilot, all need to be accounted for to derive the perfect equation per mission design series

(Vara, 2013).

Due to this uncertainty, the AMC/A3T formula works well as an executive tool

across the MAF to determine a seasoning rate. However, let's suppose one wants to

estimate a seasoning rate specific to an MWS, recall the following discussion from the

methodology chapter concerning seasoning rate development.

Seasoning Rate Development Assumptions

1. To keep the ratio of .43 inexperienced pilots to .57 experienced pilots constant among the 11 active duty units studied, flow out of the C-17 community will equal flow in. Historically, among these units AFPC and AMC/A1 indicate the inflow to outflow to be approximately 14 pilots per unit (AMC/A8PF, 2013).

2. To become eligible for upgrade, C-17 pilots must accrue 1000 total hours and, for this analysis, it's assumed all pilots will graduate UPT with 200 hours and secure an additional 200 hours in simulator time as an inexperienced pilot. Therefore, the experiencing definition will be set at 600 hours.

3. Unit commanders and operations officers will effectively monitor flying hours to ensure inexperienced pilots also receive 400 hours of primary time before becoming experienced pilots, and ensure scheduling to upgrade pilots within the normal 24 to 36 month timeframe.

4. Attached pilots are considered outside the scope of this study and are not captured in the analysis, only the core pilots within the unit.

Equation 21 is based on the aforementioned assumptions and the AMC/A3T formula

(Equation 1 from the literature review) for the MAF aging rate.

Seasoning Rate

$$= \frac{(\textbf{\textit{Flow in Per Unit}} \times \textbf{\textit{\# units}}) \times (\textbf{\textit{Upgrade Hrs}} - \textbf{\textit{Accrued hrs}})}{(\textbf{\textit{Total Pilots}} \times \textbf{\textit{Inexp Pilot Ratio}} \times \textbf{\textit{12 months per yr}})} \quad (21)$$

Equation 21: Seasoning Rate in Hours Per Month (Active Duty C-17 Specific)

To solve Equation 21, one must first determine the total pilots per unit using Equations 3 from the methodology.

$$Total\frac{Pilots}{unit} = PMAI \times CR \times 2\ Pilot\ Seats\ Per\ C - 17\ tail$$

$$Total\frac{Pilots}{unit} = 12 \times 3.0 \times 2\ Pilot\ Seats\ Per\ C - 17\ tail$$

$$Total\frac{Pilots}{unit} = 72$$

It is now necessary to solve the seasoning rate formula (Equation 21) by entering the assumed and calculated inputs across the 11 units studied.

Seasoning Rate

$$= \frac{(\textbf{\textit{Flow in Per Unit}} \times \textbf{\textit{\# units}}) \times (\textbf{\textit{Upgrade Hrs}} - \textbf{\textit{Accrued hrs}})}{(\textbf{\textit{Total Pilots}} \times \textbf{\textit{Inexp Pilot Ratio}} \times \textbf{\textit{12 months per yr}})}$$

Seasoning Rate

$$= \frac{(\textbf{14 Pilots} \times \textbf{11 Units}) \times (\textbf{1000 Hrs} - \textbf{200 Sim} - \textbf{200 UPT})}{(72\frac{Pilots}{Unit} \times 11\ Units \times .43 \times 12\ Mo)}$$

$$Seasoning\ Rate = \frac{154 \times 600}{792 \times .43 \times 12}$$

$$Seasoning\ Rate = 22.6\ Hrs/Mo$$

Therefore the seasoning rate of 22.6 hours per month can be compared to the

AMC/A3T MAF aging rate of 22.2 hours per month. Overall, the seasoning rate

calculated specifically for the 11 active duty units studied is slightly higher than the

AMC/A3T rate. One reason for this difference may be the assumption of not accounting

for attached pilots outside a unit as the AMC/A3T for all pilots across the MAF.

Secondly, the AMC/A3T rate accounts for all MAF airframes, to include C-12s and C-

21s which require fewer hours to upgrade and draw down the overall MAF seasoning rate

(Vara, 2013). Therefore, for future seasoning rate calculations both rates will be utilized

to see if there is an appreciable difference in the final AMC allocation. However, the .4

hours per month difference is relatively small in comparison.

3. Given a ratio of inexperienced pilots to experienced pilots, what is the
   resulting number of inexperienced pilots per unit, based on Primary Mission
   Aircraft Inventory (PMAI), crew ratios (CR)?

As discussed in the literature review, AMC/A3T maintains a .43 inexperienced

ratio to .57 experienced pilot ratio. This supports the larger Air Force objective of

aircrew management in meeting near-term, operational requirements while building

leaders for tomorrow, thereby ensuring a healthy aircrew force (i.e., combat ready and

sustainable) to effectively support current and future Air Force missions (HQUSAF-

A3O/AT, 2009, pp. 5-8). Therefore, AMC provides and broadens leaders for tomorrow

by allowing experienced pilots to leave the MAF and pursue opportunities in the greater

Air Force.

To find the number of inexperienced pilots per unit, take the total number of

pilots per unit and multiply by the inexperienced ratio of .43 using Equation 4.

$$Inexp\frac{Pilots}{Unit} = Total\frac{Pilots}{unit} \times Inexp\ Ratio\ (AMC\ A3T)$$

$$Inexp\frac{Pilots}{unit} = 72\frac{Pilots}{unit}\ X\ .43\ Inexp\ ratio = 30.96$$

The summary of the results is shown in the far right column of Table 7.

Table 7: C-17 Inexperienced Pilot Calculations Based on PAA & Crew Ratio

UNIT	PMAI	Crew Ratio	Total Pilots	Inexperienced Pilots
60 AMW/21 AS	12	3	72	30.96
62 AW/10 AS	12	3	72	30.96
62 AW/4 AS	12	3	72	30.96
62 AW/7 AS	12	3	72	30.96
62 AW/8 AS	12	3	72	30.96
305 AMW/6 AS	12	3	72	30.96
436 AW/3 AS	12	3	72	30.96
437 AW/14 AS	12	3	72	30.96
437 AW/15 AS	12	3	72	30.96
437 AW/16 AS	12	3	72	30.96
437 AW/17 AS	12	3	72	30.96

4. Historically, what is the average training and mission sortie duration by active duty unit?

To determine the historical average for both training and mission sortie duration, apply the methodology outlined in Chapter 3 and filter the data accordingly by unit. The data in Table 8 outlines the results.

Table 8: Unit Historical Training and Mission Average Durations

UNIT	Avg Training	Std Dev	Avg Msn	Std Dev	# Removed
60 AMW/21 AS	3.937804878	1.230755453	4.948363637	2.817633321	6
62 AW/10 AS	3.133428572	1.358936906	5.255910705	2.676510063	5
62 AW/4 AS	4.161842105	1.846606183	5.094288793	2.633524762	6
62 AW/7 AS	3.595588235	1.842370806	5.375572738	2.616873474	3
62 AW/8 AS	3.926388888	1.929191362	5.522698413	2.789563052	2
305 AMW/6 AS	4.15261708	1.430997788	4.46682243	3.154522913	6
436 AW/3 AS	2.32713964	1.591013454	4.029022557	3.067726942	4
437 AW/14 AS	2.844920635	1.734173899	4.142998205	2.858787106	4
437 AW/15 AS	3.346568627	1.371994184	3.970820105	2.811945513	3
437 AW/16 AS	2.968553458	1.713618531	3.557432432	2.486124389	2
437 AW/17 AS	2.9447861	1.629665952	4.572865497	3.230892123	1

The data in Table 8 shows an appreciable amount of variance as indicated by the standard deviation for either a training or mission duration. Potential reasons for the variance may be attributable to mission type, departure aerodrome and arrival aerodrome, and environmental impacts on the sortie like weather. All of which were not contained in data set. For example, revisiting Table 2, the data set for O&M funded training missions includes local trainers, JA/ATTs, test and ferry, and Red Flag support missions—thus the durations may vary pending the mission type assigned. The same is true for the TWCF missions. A primary factor to consider is the departure and arrival destination for each leg of a mission. For example, a mission leg from McGuire to Dover Air Force Base might be a mere 45 minutes, but a follow on leg to Ramstein Air Base might be 7 hours. The variation between the legs is the large, but the average over the two sorties would be near 4 hours for a given unit. Therefore, the standard deviation might not tell us much about the average duration other than the duration per mission leg will vary due to a number of factors.

5. Given the results from questions 3 and 4; what range of tails can be suggested to the AMC/CC as potential decision options in meeting the targeted seasoning hours in terms of basic and augmented crews?

To answer the fifth investigative question one must execute the calculations for Equation 3 through Equation 18 as discussed at the end of the methodology section in Chapter 3. In the final phase of results and analysis it becomes necessary to create an estimate for the minimum range in number of C-17 tails per day for future allocations in meeting a targeted seasoning rate. Once the average training and mission durations are found by unit, the Table 9 and Table 10 can be created by running through the final few

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equations discussed in phase 3 of Chapter 3 for either a 22.6 hours per month or 22.2

hours per month seasoning rate.

Table 9: AMC Tail Allocation by Unit for 22.6 Hours/Month Seasoning Rate

| Squadron (22.6 Hrs/Mo)	All Basic (Tails/Day)	All Augmented (Tails/Day)
21 AS	5	3
14 AS	6	4
15 AS	4	2
16 AS	7	4
17 AS	6	3
10 AS	5	3
8 AS	5	3
7 AS	5	3
4 AS	5	3
3 AS	7	4
6 AS	6	3
AMC Total (Tails/Day)	**61**	**35**

Table 10: AMC Tail Allocation by Unit for 22.2 Hour/Month Seasoning Rate

Squadron (22.2 Hrs/Mo)	All Basic (Tails/Day)	All Augmented (Tails/Day)
21 AS	5	3
14 AS	6	4
15 AS	3	2
16 AS	7	3
17 AS	6	3
10 AS	5	3
8 AS	5	3
7 AS	5	3
4 AS	5	3
3 AS	7	4
6 AS	6	3
AMC Total (Tails/Day)	**60**	**34**

The difference between Table 9 and Table 10 is a mere 1 tail per day, due to

increasing the seasoning rate for inexperienced pilots from 22.2 hours per month to 22.6

hours per month. Recall, the 22.6 hours per month was calculated via the methodology

proposed in this paper, and the 22.2 hours per month seasoning rate is the calculated via the AMC/A3T flying hour model.

To tell the full story of the data analysis, one must overlay the C-17 tails executed from January to June 2013 against the proposed allocation offered in this research project. The term "glide path or glide slope" is often used to describe the vertical descent an aircraft makes as it prepares to land (Merriam-Webster, 2013). In reference to this study, one can build a glide path to monitor daily tail execution off the lower bound of augmented tails against the upper bound of basic crewed tails. Finally, overlaying the data set analyzed in this study provides a reference to where the actual tail execution falls within the proposed range in executing tails. The glide path comparing the actual tail execution between January and June of 2013 against the range determined in this study is shown in Figure 7.
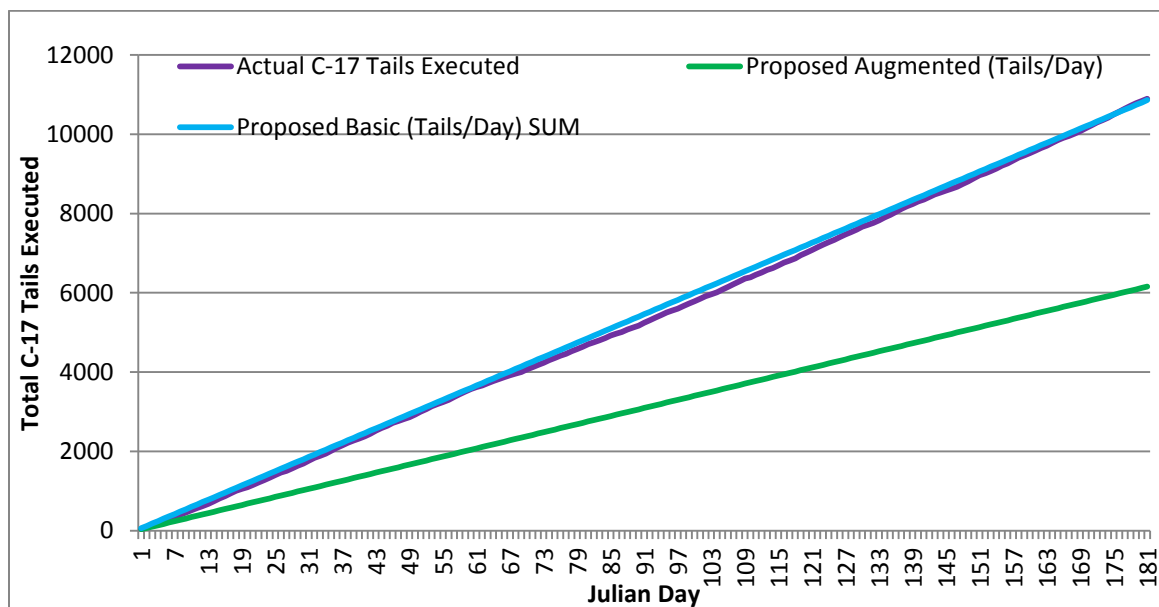
Figure 7: Glide-path AMC Tail Execution against Proposed Tail Allocation

In Figure 7, the three lines provide a visual depiction of the relationship between an upper bound, lower bound, and actual C-17 tails executed over time. The vertical axis represents the number of C-17 tails executed and starts at zero at time equal to zero. The horizontal axis is the time axis and is in Julian day units starting with January 1, 2013 and terminates at 2359 Zulu on June 30th 2013. The upper bound is depicted by the blue line. Recall, the upper bound represents AMC executing 60 tails per day via the allocation proposed in this study at AMC/A3T's 22.2 hours/month seasoning rate. The green line represents the lower bound, and represents AMC's 34 tails per day with an all augmented crewed C-17 force via the proposed unit allocation. As each Julian day passes the rate is summed to form the upper and lower bound, thus creating the confines of the glide-path.

The purple line represents the actual number of C-17 tails executed per day during the analyzed time frame summating to 10, 894 data points. Basic visual analysis appears to indicate the actual number of tails executed per day rides at or just below the proposed basic crew tail allocation in this study. The proposed glide-path shows a potential method to monitor CAAP by providing a visual depiction of how C-17 tails are being executed against a desired seasoning rate. However, because a summation process may hide the normal ebb and flow of how requirements flow, it's better to view the analysis with day to day fluctuations. Figure 8 shows the analysis this way.
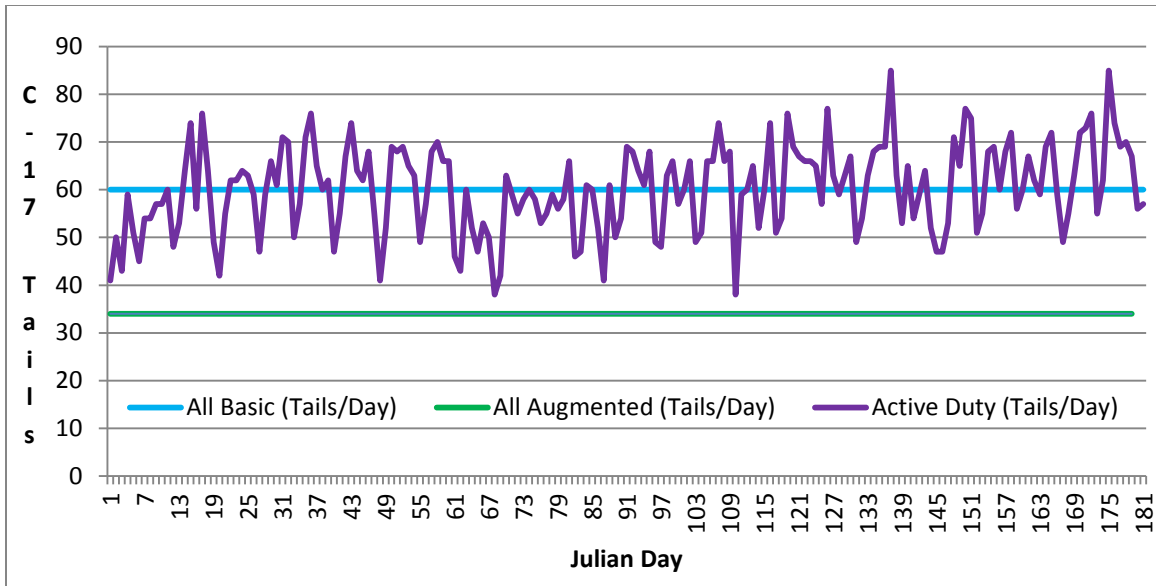
Figure 8: C-17 Tail Analysis Over Time

Like Figure 7, Figure 8 shows the upper bound as a blue line (60 tails/day) and

the lower bound as a green line (34 tails/day) based on the 22.2 hours per month

seasoning rate. However, Figure 8 holds the basic and augmented tail allocation rate

steady rather than summing the daily allocation over time as depicted in Figure 7.

Secondly, the purple line which again represents the actual allocation and execution of C-

17 tails provides a visual depection of the ebb and flow of requirements executed over the

January to June 2013 timeframe.

From the last section of the literature review, recall the GAO has stated the DoD

has historically failed in sustained contingencies to establish a process for monitoring

flying hours based on tails allocated and flown in meeting the minimum training and

seasoning requirements (USGAO, 2013, p. 2). Additionally, such a monitoring process

might be considered vital to determining a point at which DoD training and seasoning

requirements are met while shifting excess requirements to the Civil Reserve Air Fleet.

Mainly due to the fact that over flying assets can be detrimental to the long term health of the C-17 fleet and is in violation of national policies. Figure 8 represents a potential method of tracking and monitoring allocation within proposed upper and lower bounds that meet targeted training and seasoning rates. As depicted in Figure 8, there appear to be points in which the daily allocation went above the upper bound, indicating potential excess requirements that could possibly be shifted to the CRAF. However, it is imperative to point out this research didn't investigate the types of cargo moved or any special cargo handling requirements moved on any mission. Therefore, the researcher cautiously points out that not all requirements can be moved by CRAF. Further investigation and research is required to reach a conclusion on what days or what amount could be shifted from the C-17 force to the CRAF.

6. Given a prediction of flying austerity will require AMC to fund 100% of seasoning from the O&M budget; how many additional tails per year will AMC have to allocate?

To answer the sixth and final investigative question the research assumes a prediction of flying austerity equates to 100% of AMC's future tail allocations being O&M funded. Thus, the researcher attempts to determine how many additional tails per year must be tasked to attain the desired 22.2 seasoning rate assuming the FY 2013 O&M baseline remains constant. Recall, that from the beginning chapter 3 that 1,413 tails were O&M funded over the six month period studied. Therefore, the researcher assumes that in future years the baseline will be 1,413 tails per six months or 2,826 O&M funded tails annually among the 11 active duty units.

To determine the additional tails AMC will have to supplement the baseline, the researcher will subtract the annual number of O&M baseline tails from the expected total

number of annual AMC tails calculated via this research. Thus, the research will yield

two potential supplements; an all basic upper bound and all augmented lower bound in

completing the analysis. Utilizing the inputs from Table 10 and applying Equation 19

and Equation 20 from Chapter 3 the following results are obtained.

Upper Bound

$$Basic\ Supp\ \frac{Tails}{Year} = \left(Total\ AMC\ Basic\ Tails\ \times\ 365\frac{Days}{Year}\right) - 2,826\frac{Tails}{Year}$$

$$Basic\ Supp\frac{Tails}{Year} = \left(60\frac{Tails}{Day} \times 365\ \frac{Days}{Year}\right) - 2,826\frac{Tails}{Year}$$

$$Basic\ Supp\frac{Tails}{Year} = 19,074$$

Lower Bound

$$Augment\ Supp\frac{Tails}{Year} = \left(Total\ AMC\ Aug\ Tail\ \times 365\frac{Days}{Year}\right) - 2,826\frac{Tails}{Year}$$

$$Augment\ Supp\frac{Tails}{Year} = \left(34\frac{Tails}{Day} \times 365\frac{Days}{Year}\right) - 2,826\frac{Tails}{Year}$$

$$Augment\ Supp\frac{Tails}{Year} = 10,124$$

In a flying austerity environment an assumption is made that all C-17 flying

comes AMC's O&M budget due to a lack of TWCF requests.   The number of tails

required to supplement FY 2013 O&M baseline ranges from a lower bound of 10,124 to

an upper bound of 19,074 additional C-17 tasked tails.   Thus, the AMC C-17 O&M

budget would potentially increase on the magnitude of 359% to 675%. This dramatic

increase in the O&M budget might be reduced if there was a known steady flow of

TWCF missions to supplement training and seasoning hours. In the end, the research

concludes a prediction of flying austerity will have a significant impact on AMC's O&M

budget unless force structure and seasoning rates are reduced or offset with TWCF supplement missions.

Summary

Overall, the results and analysis discussed in this chapter provide potential solutions to the six investigative questions proposed in chapter 1 of this research study. The research supports the implementation and further development of the CAAP CONOPS in support of C-17 tail allocations. Furthermore, as CAAP evolves AMC has the unique opportunity to synchronize the flying hour program, seasoning rate, and training goals with the CAAP's goal to effectively allocate training and mission tails. In the end, the research concludes there are potential options for minimizing the effects of future flying austerity that senior leaders may employ to meet readiness goals and minimize excess stress on the force.

V. Conclusions and Recommendations

"I am turned into a sort of machine for observing facts and grinding out conclusions" -
Charles Darwin

Chapter Overview

This Chapter examines the basic conclusions about the research presented with in

the study and the significance of the findings. Additionally, it provides managerial

recommendations and areas for future research consideration.

Conclusions of Research

Revisiting the problem statement in chapter one, the goal of this research was to

attempt to provide potential options to combat seasoning and readiness problems facing

future Air Force senior leaders and the Mobility Air Forces crew force. Specifically, the

research proposes a methodology in chapter three that enables AMC to estimate a range

in C-17 tails to meet aircrew seasoning requirements given a prediction of future flying

austerity. If the assumptions outlined in chapter three remain valid, the minimum range

concluded is 34 to 60 C-17 tails per day based on the AMC/A3T seasoning rate of 22.2

hours per month. The range increases to 35 and 61 tails per day, assuming an MDS

specific rate of 22.6 hours per month is targeted. As supporting evidence to this claim,

the chapter four tables and figures provide AMC with the ability to track and monitor the

CAAP to prevent a serious future readiness problem, given the unpredictable nature of

the budget and slowing airlift demand. Figure 7 and Figure 8 present the COMMAFOR

with a potential method to determine when excess requirements above the concluded

range can be offloaded to the CRAF in accordance with DoD policies. Finally, the

number of tails required to supplement FY 2013 O&M baseline ranges from a lower

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bound of 10,124 to an upper bound of 19,074 additional C-17 tasked tails. If the research

assumptions are valid the AMC C-17 O&M budget would potentially need to increase on

the magnitude of 359% to 675% above the FY 2013 levels.

Significance of Research

This research endeavor is significant because it is the first attempt to correlate C-

17 tail allocation against a seasoning rate required to meet future force readiness. The

unpredictable nature of airlift demand, coupled with a potential future fiscal crisis,

provides the thrust behind this study. This research is significant because it provides

senior leaders with potential options for executing future CAAPs to meet readiness and

budgetary challenges. Moreover, there is no reason the proposed methodology can't be

adopted and employed to evaluate other major weapon systems across AMC to provide

options and prevent future readiness shortfalls.

Probably the most significant aspect is the methodology is repeatable, easily

transformable, and flexible to meet future challenges should crew ratios, PMAI,

experiencing percentages, flying durations, training and seasoning requirements vary

with demand or budget shortfalls. For the Air Force, the bottom line is national security

and the C-17 is a key asset employed in supporting the Air Force's Rapid Global

Mobility distinctive capability. In the end, this research provides an avenue to maintain

the C-17 pilot readiness for an unpredictable future and ensures AMC has the necessary

skill sets to answer our Nation's call to arms.

Recommendations for Action

The research provides a basis to begin a dialogue on the discussion of CAAP and how its implementation can best be synchronized to meet the flying hour programs training and seasoning requirements in the most cost effective manner. Consideration should be given to the allocations proposed in this research and provide an opportunity to address concerns from commanders on all levels in combating future flying austerity and readiness shortfalls. Testing the range of allocations at the unit level with careful staff supervision would be the ideal method to validate the research and amend the process to account for any shortcomings not apparent in this research. Senior leaders will need to be pro-active about right sizing the force structure and increase O&M funding in the event of flying austerity.

Recommendation for Future Research

There are several recommendations for further research. First, it is recommended for AMC to investigate the ratio of C-17 tails executed with basic versus augmented crew compliments. This ratio is important in defining a starting point for determining the level of flexibility that can be built into future allocations since it may not be realistic to send every tail out with a basic or augmented crew. Further research into developing a specific process to measure, monitor, and mitigate seasoning shortfalls associated with the exact inflow of inexperienced pilots and outflow experienced pilots per MDS would greatly benefit AMC in maintaining a balanced crew force.

Another recommendation is to determine what the average sortie length and standard deviation is based on weighted averages for missions types: training, special assignment airlift missions, channel, theater direct delivery etc. This way, future allocations can be weighted a based on mission type. For example, if the level of data was sufficient to determine that 95% of all the missions executed by a C-17 are SAAM's, then the resulting SAAM sortie durations would carry 95% of the weighted duration creditability.

Over the last several years the Air Force has been striving for fuel savings and has implemented a number of innovative programs aimed at increasing efficiency. In 2012 AMC established the Fuel Efficiency Office (FEO) to pave the way in curbing fuel costs as the Air Force spent almost $8 billion on jet fuel in 2012—$4.7 billion was used by the MAF (Maybury, 2012, p. 8). Therefore, from a common sense perspective, flying less through a more efficient tail allocation will yield substantial fuel savings in the coming years. The real question though is how much? To take advantage of these fuel savings future research should attempt to estimate the value at both the basic and augmented tail allocation levels. Although it's hard to speculate what the fuel savings would be in dollars, a good argument can be made that a reduction from 70 to 34 tails flying per day would yield a substantial savings to AMC, the Air Force, and the American taxpayer.

The research analysis in this study is built on the basis of a "keep it simple" philosophy. Thus, it makes it easily adaptable to other components, like the Air Force Reserve and the Air National Guard, as well as other major weapons system across AMC. Therefore, the research can be expanded to include other weapon systems like the KC-135, KC-10, C-5, C130 and C-21 for comparison. Further research may shed some light

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on supporting or retracting existing assumptions and provide a means to include the Reserve and Air National Guard requirements into a more complete picture of the CAAP. Moreover, further research in this area will provide another layer of knowledge to expand and build upon the topic and concepts presented.

Further research should also focus on leveraging savings by expanding training and seasoning requirements to the C-17 weapon system trainer, also known as the simulator. Over the years as technology has improved, the C-17 simulator has evolved and benefited from technological innovations. Not to mention it's less expensive to operate in comparison to the real aircraft. Technological evolution has created a training system that virtually mimics reality anywhere in the world and arguably provides a higher level of training while promoting pilot proficiency. Therefore, investigating simulator availability and the potential benefits of moving training events and seasoning hours to the simulator may provide a further reduction in tails. Thus, bridging future flying and budget shortfalls while meeting readiness demands at a greatly reduced cost to AMC.

AMC plays in important role in the financial stability of our CRAF partners within the commercial passenger and air-cargo industry. Every year CRAF partners provide critical support to AMC by flying missions associated with the commercial fixed and expansion buy programs. As stated earlier in this research commercial aircraft are far more fuel efficient and less costly to operate than military aircraft. Thus, AMC leverages these efficiencies by supplying CRAF participants with business when requirements exceed the command's readiness and seasoning requirements. The research presented within this study provides a process to effectively forecast C-17 AMC

readiness and seasoning requirements. Therefore, further research is needed on this topic determine potential benefits or drawbacks of using the proposed methodology to stabilize forecasts for buying programs to CRAF participants.

Due to the fact that all pilots onboard a mobility aircraft may log flying hours towards total time, unit commanders and operation's officers must delicately balance seasoning against the quality of training per crewmember. As much as it is desirable to increase the number of pilots onboard to secure seasoning hours, it comes at a cost in decreasing quality of training per aircrew member. That is the quality of actual hands on training and seasoning per flyer decreases because the time at the controls is divided up between all the pilots on board. Thus, operation's officers and commanders have to effectively manage the quality of training versus the total seasoning per crew member. Further research potentially in the form of a survey or Delphi Study would be valuable in determining where this critical balance lies. In the end, further research on this topic is required to determine what range or mix of pilot skill levels maximizes both quality of training and seasoning per crewmember.

Summary

The goal of this study was to estimate the minimum range of C-17 tails tasked by AMC on daily basis in either basic or augmented crew compliments that will meet the established seasoning requirements. The research estimated the minimum range to be 34 to 60 C-17 tails per day based on a 22.2 hour per month seasoning rate. This research endeavor is noteworthy because it is the first attempt to correlate C-17 tail allocation against a seasoning rate required to meet force readiness. Additionally, the research

provides Air Force Senior leaders with information and options in creating a common operating picture in developing a balanced allocation between seasoning and cost.

More importantly, the research offers Air Force leaders a pro-active tool to mitigate the adverse effects of future budget restrictions based on a prediction of flying austerity. Further research into the quality of training, Guard and Reserve requirements, and forecasting to smooth out commercial buys for CRAF partners will only add to the knowledge field and solidify the findings presented here. Finally, the research lays initial ground work on how AMC can incorporate this methodology and apply it to other weapon systems across the enterprise to meet aircrew seasoning requirements while simultaneously avoiding readiness shortfalls in a peacetime posture.

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REPORT DOCUMENTATION PAGE

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1. REPORT DATE (DD–MM–YYYY)	2. REPORT TYPE	3. DATES COVERED (From — To)
13-06-2014	GRP	June 2013 - June 2014

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Estimating C-17 Aircrew Seasoning Given A Prediction of Flying Austerity	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
Rovello, Frank, W., Major, USAF	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)	8. PERFORMING ORGANIZATION REPORT NUMBER
Air Force Institute of Technology Graduate School of Engineering and Management 2950 Hobson Way WPAFB OH 45433-7765	AFIT-ENS-GRP-14-J-13

9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES) \	10. SPONSOR/MONITOR'S ACRONYM(S)
Air Mobility Command Colonel Steve Stator & Colonel William Hall HQ AMC/A3O 402 SCOTT DRIVE, UNIT 3A1 Steven.stator@us.af.mil; william.hall.1@us.af.mil	AMC/A3O
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION / AVAILABILITY STATEMENT
Distribution statement A. Approved for public release, distribution unlimited

13. SUPPLEMENTARY NOTES

14. ABSTRACT
The purpose of this Graduate Research Project is to focus on estimating a minimum range in C-17 tails required to meet Air Mobility Commands active duty aircrew seasoning requirements, given a prediction of future flying austerity. The researcher employs a three phase case study. Phase one focuses on the historical analysis of asset allocation and the current process referred to as the Commander Air Force Forces Appropriation and Allocation Process. Phase two begins the data analysis, focusing on sorties flown by active duty units from January to July 2013, which determines average training and mission sortie duration. Finally, phase three merges the results from phases one and two in order to estimate a minimum range in tails required to meet a targeted seasoning rate in hours per month for both basic and augmented crews. The methodology employed concludes the CAAP is suited to monitor C-17 allocations to offload excess requirements in accordance with Department of Defense policy and prevent serious future readiness shortfalls given the unpredictable nature of the budget and reduced airlift demand in the event of future flying austerity.

15. SUBJECT TERMS
Aircrew Seasoning, Experiencing, Aging, CAAP, C-17 Tail Allocations

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE	UU	86	Col Doral E. Sandlin, AFIT/ENS
U	U	U			19b. TELEPHONE NUMBER (Include Area Code) ((937) 255-3636 X4740 doral.sandlin@afit.edu